THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXV. No. 1668.] LONDON, APRIL 30, 1895. [47TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.

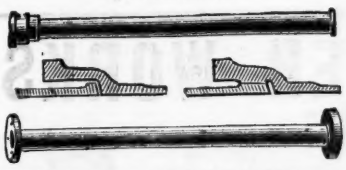

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Fig. 600. "CORNISH" STEAM-PUMP FOR WATER.

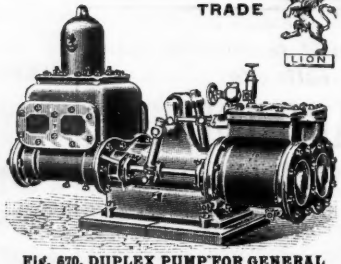

Fig. 670. DUPLEX PUMP FOR GENERAL PURPOSES.

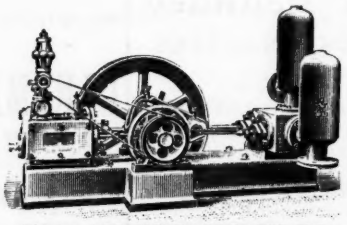

Fig. 685. "RELIABLE" PUMP FOR TAR AND THICK FLUIDS.

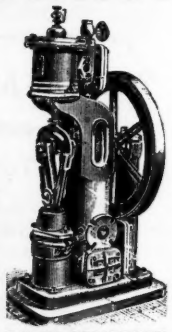

Fig. 705. SINGLE RAM PUMP FOR BOILER FEEDING, &c.

JOSEPH EVANS & SONS, Hydraulic Engineers,

WOLVERHAMPTON. LONDON OFFICE: 16, Union Court, Old Broad Street, E.C.

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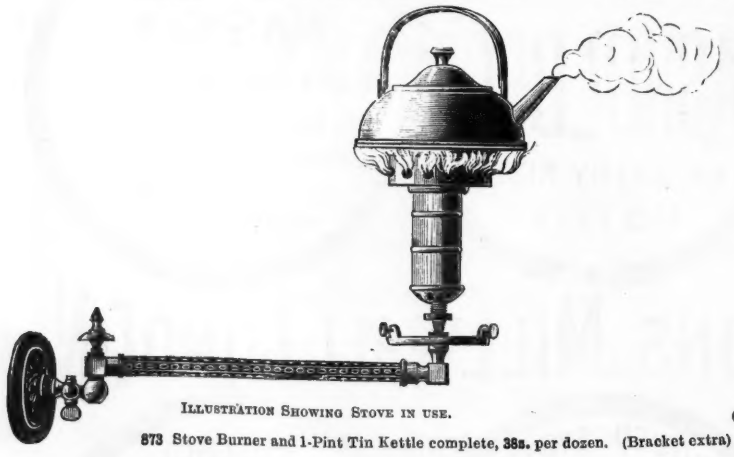
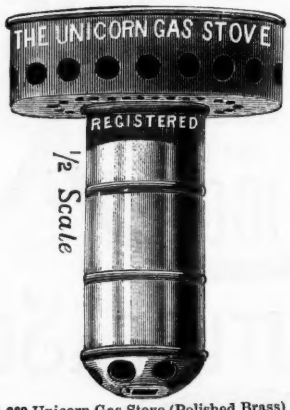


ILLUSTRATION SHOWING STOVE IN USE.

873 Stove Burner and 1-Pint Tin Kettle complete, 38s. per dozen. (Bracket extra)



G 869 Unicorn Gas-Stove (Polished Brass) 24s. per dozen.

G 870
Cast Unicorn Burner, 5s. per dozen.

THIS STOVE is **invaluable** for **Bedrooms** and **Kitchens. No other Gas-Stove equals it for quickness.** It simply slips over the Burner which is supplied with the Stove, and which thereby is at once converted into an atmospheric burner. When the Burner is not needed for the Stove, it remains in the bracket, and acts as an ordinary Comet Burner. The Kettle has a sunk well, and rests securely on the Stove, **which must always be lighted from the top.**

WILL BOIL A PINT OF WATER IN A FEW MINUTES.

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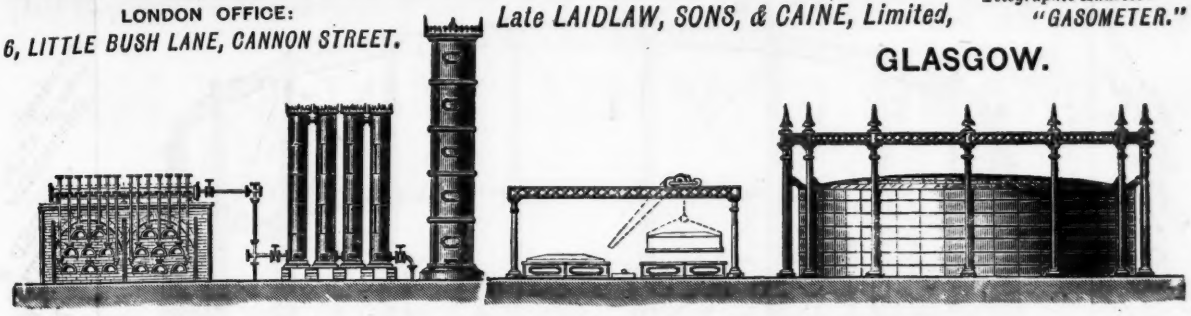

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GAS EXHAUSTING MACHINERY

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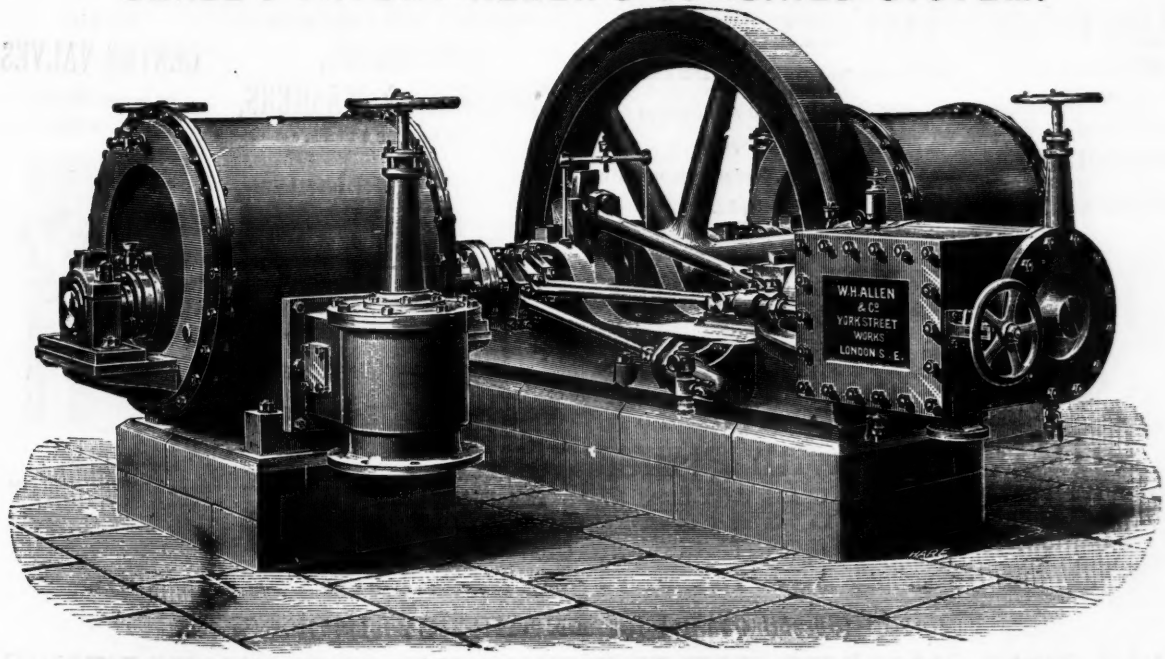

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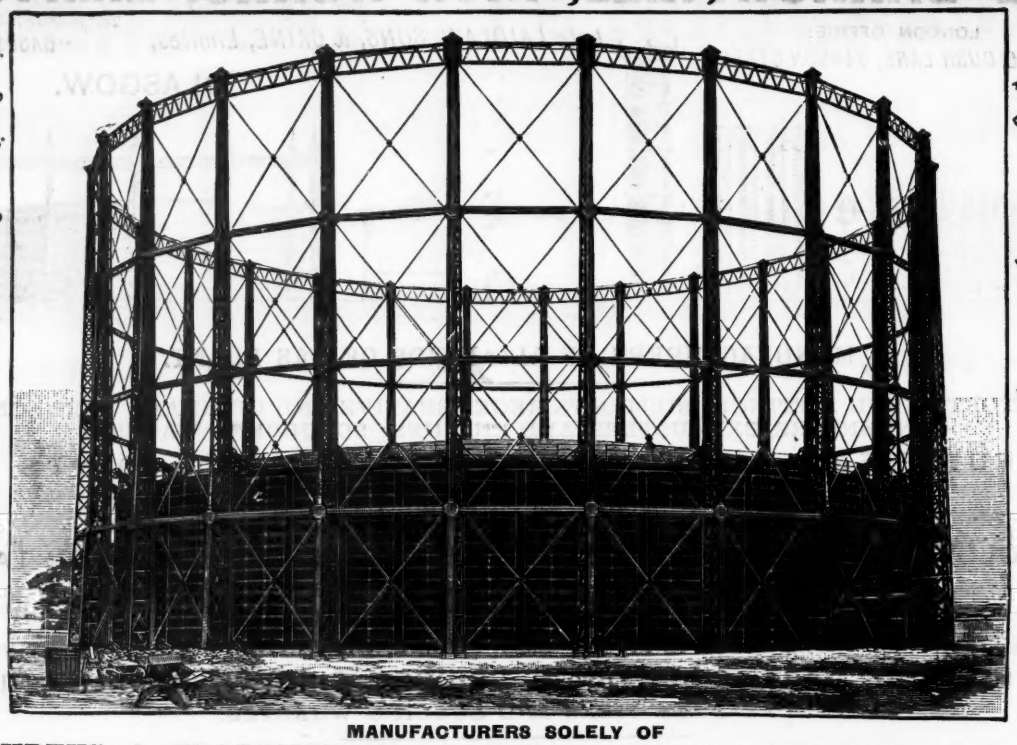

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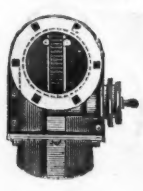

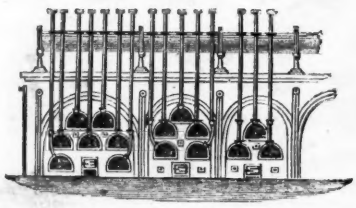

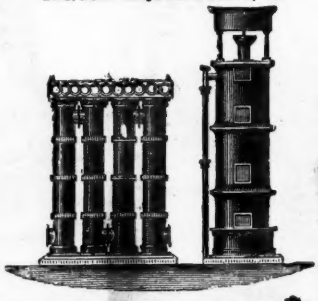

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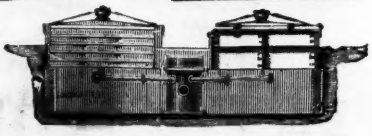

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Great Reduction in Prices

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The Mantles manufactured by the Incandescent Gas-Light Company can only (as provided by the terms of the limited licence granted with each Mantle) be lawfully used on Burners of the Company's own manufacture. Any person who sells one of the Company's Mantles with, or for use on, any other Burner, and any one of the public who uses one of the Company's Mantles on any Burner not of the Company's manufacture, will render himself liable to proceedings for **Infringement of the Company's Patents.** All persons are therefore warned against having anything to do with Burners not bearing the name of the Incandescent Gas-Light Company stamped upon them.

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ALDWARKE MAIN GAS COAL
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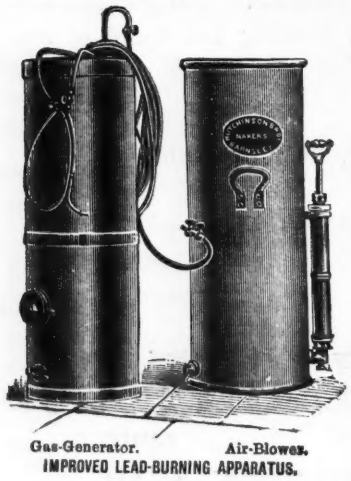

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IMPROVED LEAD-BURNING APPARATUS.

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SATURATORS, all Lead, or Strong Sheet Lead, in Wood Casing,
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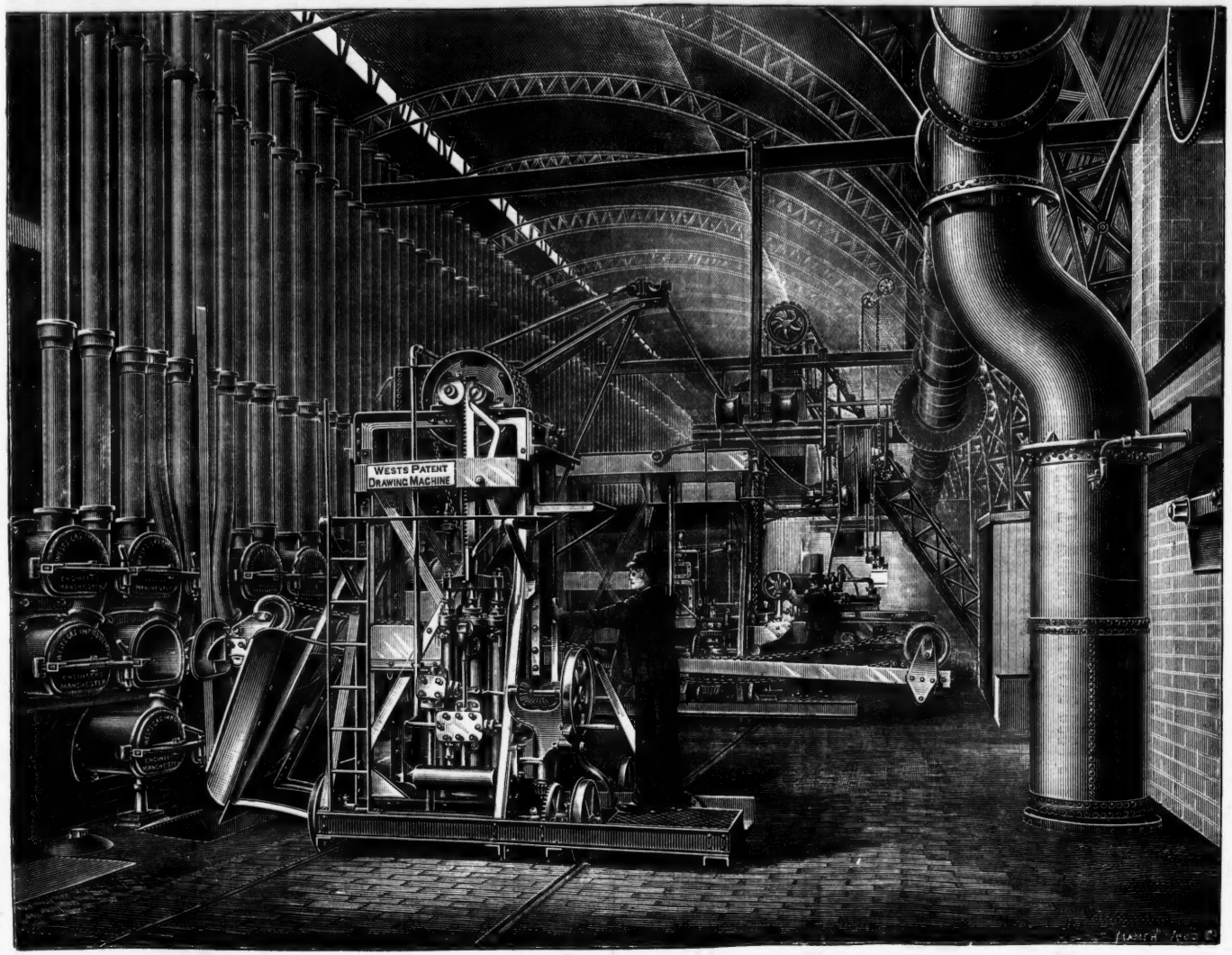

Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

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DAILY

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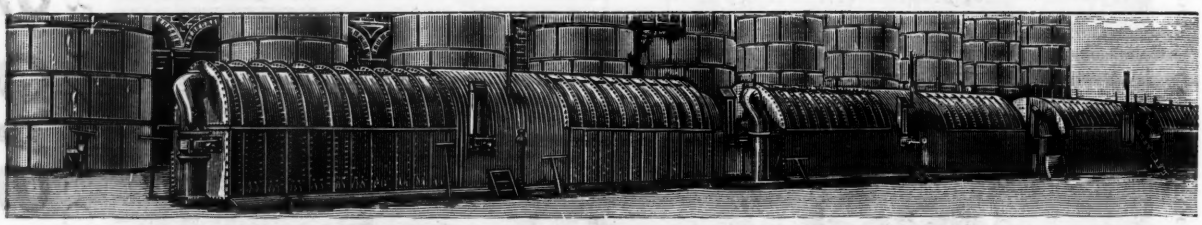
PATENT "STANDARD" WASHER-SCRUBBER

☛ **492** of these Machines (capable of dealing with **472,540,000** cubic feet of Gas daily) in use, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have 30 of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

MARSHALL'S PATENT BATTERY CONDENSER & SCRUBBER.

This apparatus being made in sections, the capacity can be easily and cheaply made proportionate to increased make of Gas. Other advantages are: Large and effective cooling area on small ground space, slow speed, no repairs required, high strength liquor obtained, &c.

MARSHALL'S PATENT TAR-EXTRACTOR.

Extracts practically all the Tar without choking up, and gives minimum back-pressure.

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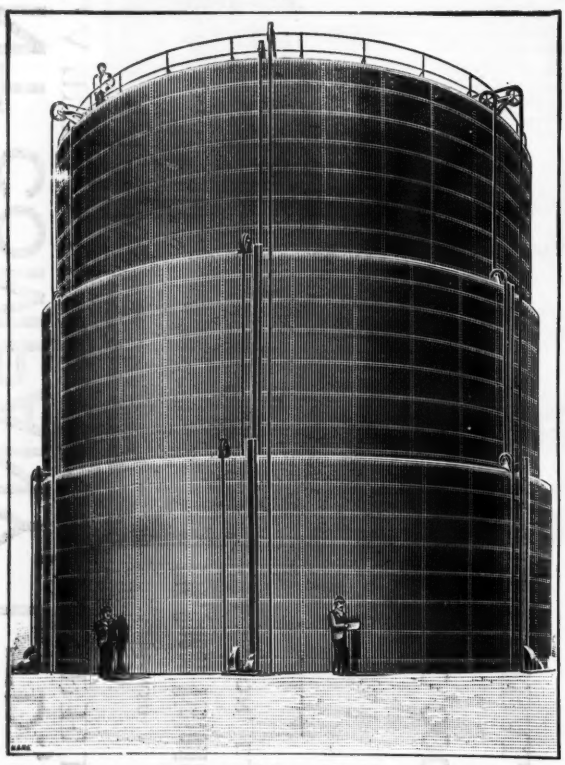
GAS-WORKS CONTRACTORS,

STOCKTON-ON-TEES.



From Photo. of Three-Lift Roped Holder, 50 feet diameter by 18 feet deep each Lift. Erected at Sligo, 1894.

Pease's Patent Roped Gasholders

THESE HOLDERS HAVE WORKED SUCCESSFULLY UNDER EVERY TEST TO WHICH THEY HAVE BEEN SUBJECTED SINCE 1889.

MAY BE SEEN AT MANY PLACES.

Send for Catalogue if requiring increased Storage.

The security afforded by this System is shown by the working of the Three-Lift Holder, the subject of this engraving; not only was the Holder unaffected by the recent heavy gales, but also the recorded strain on the Ropes was remarkably small.

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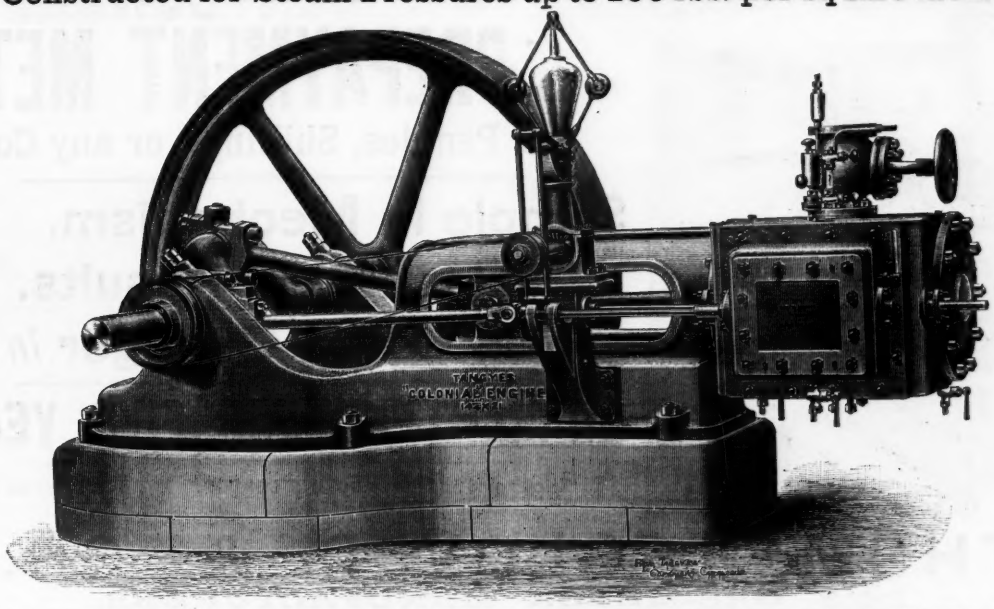
Telegrams { "GASHOLDER, STOCKTON-ON-TEES." "APPARATUS, LONDON."

TANGYES'
"COLONIAL" STEAM-ENGINE

Constructed for Steam Pressures up to 100 lbs. per square inch.



Tangyes' "Colonial½" Steam-Engine, with the TANGYE-JOHNSON PATENT AUTOMATIC CUT-OFF GEAR. From a Photograph of the 1½ in. by 2½ in. size.

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TANGYES LIMITED, Cornwall Works, BIRMINGHAM.

AND LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, JOHANNESBURG, BILBAO, ROTTERDAM, AND BELFAST.

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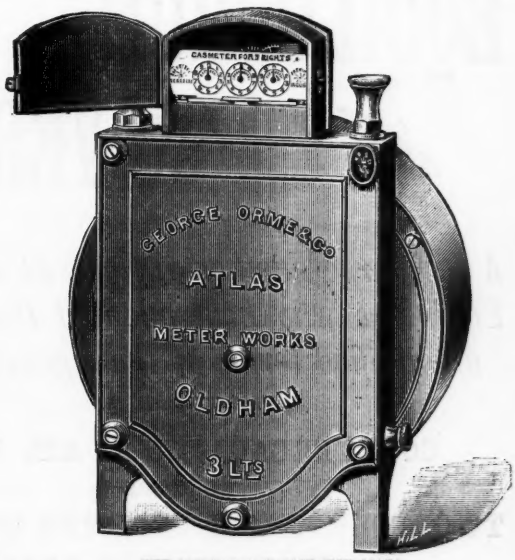

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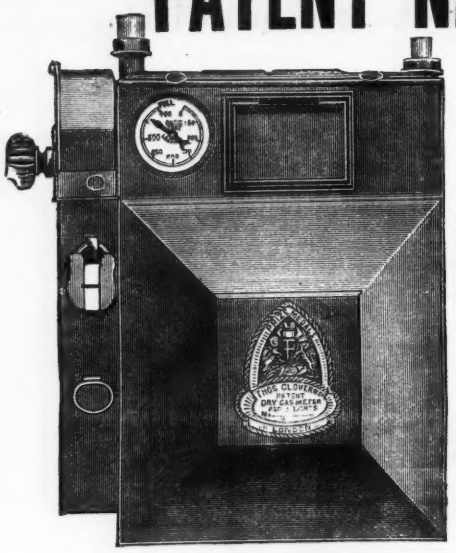

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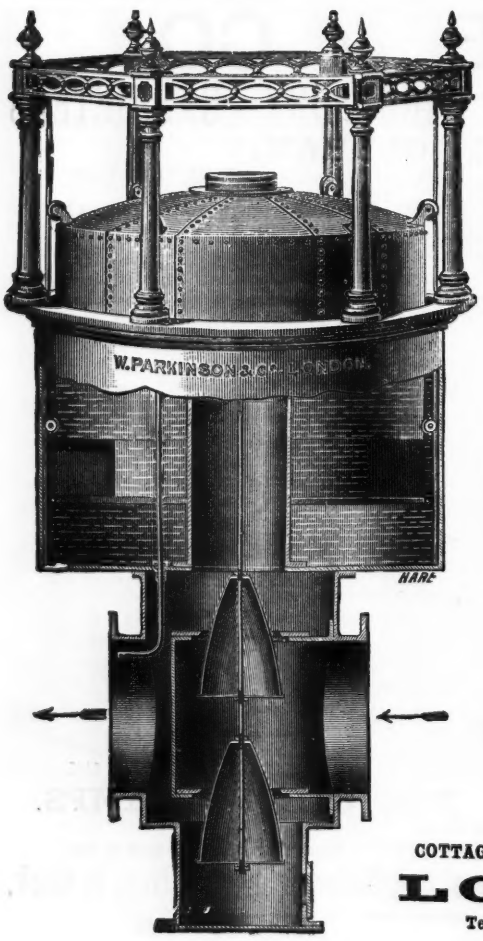

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EDITORIAL NOTES.

Colonel Makins's Last.

THE "parting shot" fired by Colonel Makins, in our "Correspondence" columns to-day, after those whom it pleases him to style defeated adversaries, is aimed with the usual skill of this most courteous of warriors; and if the adversaries alluded to do not forthwith abandon their cause, their obstinacy should doubtless be set down to the fact of their belonging, with their antagonist, to the race which proverbially never knows when it is beaten. We admit, however, that for the present no good can be expected from a prolongation of the controversy; and before proceeding to deal with our correspondent's three-pointed farewell to it, we will pause to claim, as one of its positive fruits, the establishment of the truth about the realization and working of that idea of workman-directorships which was at first mooted and attacked wholly on *a priori* grounds. Now for Colonel Makins's letter. Of course, he contends that the cases which exemplify the actuality of what he declared to be visionary do not apply to the instance of Mr. Livesey's proposal. Did we not argue, in response to Mr. John Ewart's letter, that any evidence of the kind deduced from the experience of a third party would be open to the objection that "circumstances alter cases"? Here is an illustration of the impossibility of convincing a man against his will. Colonel Makins's plea that there is "nothing in "common" between the cases he refers to, fails before the fact that the Board of Trade, whom he describes as supervising statutory companies, differ from him so radically as to bless almost effusively the policy which he condemns so implacably. Mundella, Hicks-Beach, and Bryce are a fair set-off on this point to Makins.

With regard to the second division of Colonel Makins's letter, which refers to his speech of February, 1890, and pleads that this had "nothing whatever to do with profit-"sharing or management-sharing by the Company's work-"men"—it must be our reply that we never said it had, if the word "Company" here means Colonel Makins's own, as seems to be implied by the context. What Colonel Makins was alluding to in this portion of his speech was the South Metropolitan Company's profit-sharing scheme; and his words were reported by us as follows: "He was not condemning the system that Company "had adopted, but it appeared to him that it was a scheme "which involved a *quasi*-partnership between the men and "the shareholders; and a *quasi*-partnership, at any rate "logically, to his mind, involved a right of partnership in "the management of the Company." Thus the interesting fact appears that, almost from its inception, Colonel Makins foresaw the logical development of this scheme which he has recently laboured to prove illogical, unnatural, and all the rest of it. This is indeed to put "Saul among "the prophets."

Lastly, with regard to the contention that it is not for the directors of statutory gas companies "to try to vary "the terms of a parliamentary bargain, but to carry them "out both in the spirit and to the letter," the strict meaning of such a declaration can only be that gas companies should never go to Parliament for any alteration or extension of their powers whatever, beyond such as might be obtained by the medium of a Provisional Order. Colonel Makins cannot mean this; but his words certainly do not convey any other meaning. If the constitution of the governing body of a statutory gas company is not a proper subject for the proprietors to discuss at a Wharncliffe meeting, and for settling by a Private Act of Parliament, we should like to be told what is. Colonel Makins's letter is quite as interesting to us for what it does not, as for what it does contain. Since he does not answer our railway references of last week, by his own way of arguing these might be taken to be unanswerable; but we have no desire to labour the point. Colonel Makins may think he has won a victory, inasmuch as the cause for which his opponents are contending is for the moment out of the scope of practical politics. Mr. Ewart likewise thinks the workman-director dead, and hopes he will be buried. Well, if so, he must have an obvious epitaph; for it is as certain as the earth moves that we have not seen the last of him in connection with the gas industry.

The Programme for the Meeting of the Institution of Gas Engineers.

In another column will be found the programme for the meeting of the Incorporated Institution of Gas Engineers, which is to be held on Wednesday, Thursday, and Friday of next week, under the presidency of Mr. C. C. Carpenter. The first two days' meeting will be held at the Royal United Service Institution in Whitehall, which is practically a new addition to the resources of London for the accommodation of such gatherings as this; and the third day will be devoted to an excursion to Brighton. There are ten papers included in the *agenda* for the 8th and 9th prox., which will be as many as can possibly be read and properly discussed in the time allotted for the purpose. The President's address should be well worth hearing, for Mr. Carpenter is known as an engineer of initiative and individuality. The first paper in the list is by Mr. George Livesey, and is to introduce the subject of "Old Age "Pensions." In remembrance of what we have recently had to say upon this head, we are very glad to see that the Institution are to have such a paper, by such an author. Professor Vivian B. Lewes is to descant upon "The Work of the Photometric Standards Committee;" and it will be gratifying to learn something about the doings of a body of inquirers of whom so much was expected, and who have so completely effaced themselves. Mr. G. Ernest Stevenson will read a paper on "The Modern Gas-Engine: Its Development and Appli-"cation;" and Mr. Lewis T. Wright has a highly congenial subject in "The Temperatures Employed "in the Distillation of Coal." Professor Lewes is to open the second day's proceedings with a paper on "Acetylene and its Enrichment Value," which is quite as it should be. Mr. A. E. Broadberry will describe "The "Installation of Water Gas at Tottenham"—a paper likely to interest those who are desirous of learning something of experiences with water gas in works not of the largest size. Mr. J. Husband is to deal with "Sloping "Retorts at Brentford," which have been noticed in our columns; and the paper will be a peg on which to hang a discussion on inclined retorts generally. Mr. Fletcher W. Stevenson will read a paper on "The Manufacture of "Sulphuric Acid by Makers of Sulphate of Ammonia"—not a highly controversial topic; and Mr. T. Holgate and Mr. F. D. Marshall close the list with two papers, on "Purified Ammoniacal Liquor and its Use in Gas Purifi-"cation," and on "The Monnier System of Cement "Construction as applied to Gas-Works," respectively. The list is promising, the authors are mostly fresh to the members, and good discussions may be expected on three or four of the communications. The annual dinner of the Institution is to take place on the Wednesday evening, at the Holborn Restaurant, as usual. Friday's trip is to combine a visit to the works of the Brighton and Hove General Gas Company, who will provide luncheon at Portslade, with an inspection, by way of variety, of the locomotive and carriage works of the London, Brighton, and South Coast Railway Company. It is to be hoped that the meeting will be well attended, and be otherwise successful. We shall perhaps help the Council in their efforts to procure good discussions by giving prominence to the fact that it is the intention to have prints of the papers ready a few days before the meeting, so that any member desiring to prepare himself for discussing a particular communication will be able to obtain a copy on application to the Secretary, Mr. Thomas Cole.

The North of England Meeting—Colonel Sadler on Benzol.

The members of the North of England Gas Managers' Association met on Saturday in Newcastle-upon-Tyne, under the presidency of Colonel Sadler, J.P., who read the very interesting and suggestive paper which will be found in another column. It will be generally esteemed as a timely contribution to the literature concerning the vexed question of gas enrichment by means of benzol. The speaker declared it to be his object "to show that benzol "is the best and cheapest, as well as being the most "natural enricher of coal gas." Whether he has succeeded in his effort may be matter of opinion; but it will not be contested that Colonel Sadler is one of the most competent of living authorities upon the production and uses of benzol. His paper begins with a criticism of acetylene, in its presumed capacity of a gas-enriching material; and before finishing he carries the war into the enemy's country by suggesting that, if acetylene is all that Professor Lewes's fancy paints it for this application, it may possibly be obtainable from benzol by the process of "cracking." There is much good sense, moreover, in the observation in the paper that it is disappointing to find so promising an illuminating agent as commercial acetylene "handicapped by so many objections and difficulties "in the way of its application"—an objection which he does not seem to think applies in anything like the same degree to his own favourite—benzol. Colonel Sadler makes due acknowledgment of the excellent work of Bunte and Schilling in the benzolization of poor coal gas; and he quotes the results obtained by other experimenters with the same material, which are admittedly less consistent than could be desired. With a view to establishing a datum for future discussions of a most important subject, it has been suggested that the illuminating power of benzol, burnt by itself for the purpose of enabling a direct comparison of its quality in this respect with acetylene similarly treated, should be determined. The initial difficulty in the way of such an experiment is the obvious consideration that benzol is a fluid at ordinary temperatures, while acetylene is a gas. In order to consume benzol by means of a gas-burner, it is therefore necessary to raise and maintain all the apparatus at a temperature above the boiling-point of water, at which benzol is gaseous. Colonel Sadler has not yet completed his experiments in this direction. But he is already able to state that, in the course of his researches, many most interesting phenomena have cropped up, which he promises to describe later on; and he believes that benzol will be found little short of acetylene in illuminating value. Meanwhile, as a liquid enricher of poor coal gas, Colonel Sadler thinks the commercial as well as the technical success of 90 per cent. benzol is fully established—of course, at current prices. The other business before the meeting was the reading of Mr. Hardie's short paper on "Frost and Gas Supply," which naturally aroused a good deal of interest in gas managers so recently delivered from the grip of an Arctic winter. Mr. Hardie's common-sense observations evoked a discussion of a conversational character, which might doubtless have been almost undefinitely prolonged if all the managers present had contributed narratives of their own vexatious experiences during the frost. The meeting was brought to a close by the customary dinner, when the absence of the familiar figure of the lamented Colonel Cowen was felt, and made the subject of feeling acknowledgment by the Chairman.

The Affairs of the Paris Gas Company.

The annual reports of the directorate of the Paris Gas Company are always interesting, and that for the past year is no exception to the rule. The first salient fact of the situation which the Directors are called upon to explain is another decrease of gas consumption in Paris and the 59 suburban communes served by the Company, albeit this time the falling off is less than half of the shrinkage recorded for 1893. The official mind perceives in this the sign of a near return of days of positive growth for the undertaking; and several reasons, more or less convincing, are adduced in support of this optimistic view. To begin with, redoubled efforts are being made by the Administration to develop the use of gas for both heating and cooking purposes in large establishments and in workshops. As for gas-engines, these aids to the consumption of gas are found to continually grow in popularity. Special stress is laid by the report upon the policy adopted by the Company as from the beginning of last August, in agreement with the Municipality, of remitting all accessory charges for laying on gas to tenements let for less than 500 frs. per annum. Much is expected from the development in this way of the consumption of gas by this order of customers. Finally, the use of improved gas-burners of all kinds continues to increase, and is bringing back to the Company many of the consumers who had abandoned gas to adopt electric lighting. It is admitted that the substitution of these economical burners for others which were previously in use by their regular consumers helps to account for the diminished demand for gas. According to the report, the severe frost of February did not aid the consumption of gas in Paris, by reason of the fact of a large number of meters having been stopped by this cause. Meanwhile, the day uses of gas continue to grow in importance. The Company lend cooking-stoves to all their consumers with-

out charge; and they find this policy having its due effect in popularizing gas in small households, where its use was a short time ago unknown. The day consumption is now more than 29 per cent. of the whole. A most encouraging circumstance is the unceasing growth of the number of consumers on the Company's books. No mention as to automatic prepayment meters appears in the report; yet it might be thought that these would be the very best things the Company could employ in connection with their gratis stoves and other devices for bringing gas into the homes of the less wealthy Parisians. Instead of introducing prepayment meters, the Directors have set up a system of prize awards; but how these are to work remains somewhat of a mystery. This is a pity; for we are always desirous of learning from our neighbours' experiences. There is nothing further to be said respecting the condition of the Company (which, as a matter of fact, has not grown at all for the past six years), except to express the hope that the policy of the Administration in regard to popularizing gas may be persevered in and extended. There is plenty of scope for it.

From Another Point of View.

THERE is a good deal of human nature in man, as a once popular philosopher observed, with that perception of the deep in the obvious which is reserved for genius. And when the man becomes also a scientific personage or a technical expert, his humanity does not depart from him, but remains to diversify his scientific and technical aspects. These observations are called forth by an amusing protest, in the current number of the *Electrician*, against a recent communication of M. Gréhant to the French Academy of Sciences, which describes certain experiments made by the author, with the result that carbonic oxide was found among the products of combustion of the electric arc. It appears that the French gentleman in question shut up an arc light and a live dog in the same box, or caused the contents of the box containing the light to be breathed by the dog—which amounts physiologically to the same thing—and afterwards sought in the blood from the carotid artery of the poor brute for traces of carbonic oxide, which were of course forthcoming. Our contemporary protests against the futility of such an experiment, and declares, sensibly enough, that there is no mystery about the functioning of the electric arc which needs clearing up by the intervention of "so clumsy a "piece of apparatus as a dog." In this system of lighting, carbon is burnt in air as well as vaporized; and the production of more or less highly oxidized products of combustion is consequently inevitable. Nobody but a pedant fitter for Laputa than Europe would go the roundabout way selected by M. Gréhant for establishing the existence of carbonic oxide in the atmosphere surrounding an electric arc lamp; and this egregious person deserves all the scorn our incensed contemporary pours out upon him for his stupid "scientism." But how the end affects one's appreciation of the means! We have heard of this light of French science before. It was he who rushed off to the same quarter—the Academy of Sciences—one week with a tale of how he had found carbonic oxide in the atmosphere in which a Welsbach gas-light had been burning; and the electrical journals complacently republished his wonderful discovery. He corrected it the following week, confessing that the Welsbach light was not specially given to manufacturing carbonic oxide. But the electricians took no notice of the correction; and some of them went on writing, in spite of it, most condemnatory articles on the incandescent gas-light. Even to this day, the original statement of Gréhant is probably cherished for service by electrician lecturers in obscure places, and writers in country newspapers; and we shall not be surprised to meet it again at any time. But now—ah, how different is the case of Gréhant and his *quondam* electrical admirers! He has dared to vilify the electric light by his puerile reports upon his ridiculous experiments; and consequently our electrical friends think the sooner he vivisects himself the better. Was it not said rightly that there is a deal of human nature in man?

The New Gas Manager at Darwen.—Mr. A. H. Smith, of Llandudno (eldest son of Mr. W. Smith, of the Bolton Corporation Gas-Works), was last Wednesday appointed to succeed Mr. T. Duxbury as Engineer and Manager of the Darwen Corporation Gas Department.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 913.)

THE general tendency of the Stock Markets during the past week has been firm; and some of those which suffered a long period of depression—like the American—are steadily picking up again. Indeed, prices are better all round, except in the Foreign Market, which goes heavily under the gloomy cloud which is hanging over the East. The volume of business, however, is very light, and will get lighter if members continue moving into the Kaffir Market, which is now perfectly rampant, and threatens almost to monopolize business. It looks as if the Circus might soon parody the Napoleonic "*L'Etat, c'est moi*," and say "I am the Stock Exchange." The Money Market remains in the same congested state, suffering from a plethora of gold. In the Gas Market, business was only moderate, though in the earlier portion of the week there was fair promise of some activity. The predominant feature was marked steadiness. Changes in quotation are few in number, and slight in degree; but wherever there is an alteration, it is for the better. In Gaslights, the "A" opened pretty active, and commanded good figures; but later on, it fell weaker, and looked as if the quotation were going to drop. It escaped a fall, however; and prices rallied again before the close. The secured issues were quiet but strong—good prices being very readily obtained for anything offered; and the "H" 7 per cent. advanced in price. South Metropolitans were, as in the preceding week, quite lifeless, except for a few transactions in the "B" at good figures. Commercials were quite stagnant, without any business marked, beyond a single bargain in the old stock. The Suburban and Provincial division was conspicuous by increasing prices—Crystal Palace advancing a couple of points, and Bristol being put up again to its former position. The Continental Companies presented no noteworthy feature, beyond good steady adhesion to the last quoted figures. The other undertakings also were quite devoid of incident. Business in the Water Companies was about on an average scale. But the tendency was generally rather weaker; and one or two quotations have slightly fallen.

The daily operations were: On Monday, the Gas Market opened with a very fair show of activity; Gaslight "A" having most of it. Prices all round were satisfactory; but quotations did not rise. In Water, there was a fall of 1 in East London. On Tuesday, transactions in Gas were more restricted; but improvement in value was shown by a rise of 2 each in Gaslight "H" and Crystal Palace. The weak tendency in Water was continued by a fall of 1 each in East London and Southwark ordinary. Business in Gas became quieter on Wednesday, and prices were not remarkable. Bristol recovered 1. Thursday was a quieter day still; and there was no sign of any additional improvement in quotations. On Friday, there was a recovery in point of activity; but the general run of prices remained about the same. On Saturday, better prices were obtained; but quotations closed without any further alteration.

ELECTRIC LIGHTING MEMORANDA.

Inauguration of the Electric Lighting Works of the Leicester Corporation—The Affairs of the Metropolitan Electric Supply Company—The Revenue Derived from an Electric Lamp—The Earning Capacity of Capital in Gas and Electric Supply.

ELSEWHERE we give a report of the interesting proceedings at Leicester on Thursday last, when the electric lighting works of the Corporation, which have been completed and in practical operation for some time, were formally inaugurated. As we have frequently acknowledged in earlier references to this undertaking, it possesses exceptional interest for our gas engineering readers, on account of the whole system having been designed by Mr. Alfred Colson, the Gas Engineer to the Corporation, who is the first of English gas engineers to double the parts of electric and gas engineer and works manager. The electric lighting undertaking has moreover been made in every respect an annexe of the Corporation gas-works, together with which it is administered, and by which it is housed and aided in every possible legitimate way. It is unnecessary to repeat here the details of the plant and the particulars of Thursday's proceedings; but it remains for us to congratulate Mr. Alderman Lennard, the Chairman of the Gas and Electric Lighting Committee, and his colleagues, on the successful consummation of labours which must have been both arduous and attended with no little anxiety at times. We sincerely hope the future of the new department will be such as to justify these labours. One observation may be permitted to us with regard to some remarks uttered on Thursday by Mr. J. S. Raworth, the Chief Engineer of the Brush Company, who have executed the electrical portion of the works under Mr. Colson. This gentleman appears to have read, in some comments of ours on the station at the time of the visit of the Institution of Gas Engineers to Leicester in the autumn, a reflection upon the originality of Mr. Colson's designs. What we remarked on this head was merely that the Brush Company's scheme which was finally adopted was "being carried out with modifications that seem to indicate somewhat of the Ferranti influence." If the Brush people are galled at this comment, we cannot help it;

but that in offering it we had the faintest intention of detracting from the value of Mr. Colson's work in this connection, the whole tenor of the paragraph containing the phrase in question abundantly disproves. It was not right of Mr. Raworth to convert our remark about Mr. Ferranti's "influence" as a pioneer of electrical engineering into a statement that we "saw the finger of Mr. Ferranti in this installation." We said nothing of the sort. Neither was it gracious to drag in this gentleman's name in such a way, before such a company, and on such an occasion. The responsibility for striking what might well have been regarded as a jarring note at Alderman Lennard's festive board rests upon Mr. Raworth; and it is to be hoped that by this time he is "sorry he spoke." We wish, for the rest, that, when readers do us the honour to quote from our columns, they would also do us the justice to quote correctly, as it is our habit to weigh the language we employ with very considerable care, especially when names have to be mentioned.

The eighth ordinary general meeting of the Metropolitan Electric Supply Company was held last Thursday, when the Chairman (Sir John Pender) was able to give the proprietors an encouraging account of the progress of this, the premier London central station electric lighting undertaking. The capital expended by the Company now amounts to £628,931; and the gross revenue for the year was £85,345—being an increase of £16,150 upon the income for 1893. The number of 8-candle power lamps on the Company's mains increased during the year from 166,000 to 209,000; and the report states that the number now stands at 224,000, with no sign of falling off in the applications. The Directors have taken advantage of the improved financial position to effect a reduction of debenture interest, and to strengthen the finances of the Company in various ways. Among other things, they have set aside £8000 out of profits to depreciation. This fact is significant, as showing that, whenever they have the means, prudent administrators of electric lighting undertakings are fain to make provision for depreciation. The observations of Sir John Pender upon this head are worthy of notice. He declared that the Directors of this Company do not commit themselves to an opinion as to what amount should be written off for depreciation. They recognize the fact that electric lighting is a business which is at present new, but is being gradually developed, and therefore cannot be judged altogether by the experience of other businesses. Consequently, it is impossible at present to say positively what is the proper rate of depreciation to allow for; but the Metropolitan Directors hold that "an appropriation for the purpose in question, increasing with the Company's income, and practically proportional to that income, will most justly and reasonably meet all requirements of the case."

On the important question of how much revenue an electric lighting company can expect per lamp, Sir John Pender had something interesting to say. He admitted that, when the Company was started, the Directors were under the impression that they would gather in from their customers at least £1 per lamp. At the same time, "a man connected with another company" said this was an under-estimate; and he thought the amount ought to be put at 25s. per lamp. Actually, the average rental is only 8s. 5¼d. per lamp, which, as Sir John Pender rather pathetically said, is a marked difference. "Had we got the price originally contemplated when we issued our prospectus, we should be paying a very different dividend now to what we are paying." Doubtless. But then the light would have proved very much more expensive to consumers than is actually the case; and the rate of expansion of the business would have been much slower than it has been. It is interesting to observe, in this connection, how near the mark was the rental of 1s. per candle power per annum charged by some of the early electric lighting companies before they had reliable meters to use. At this figure, which may be taken to apply to what may be called the commercial and professional categories of a lighting connection (the lamps used in offices, shops, banks, and public institutions generally), incandescent electric lighting cannot be called dear—a fact which gas manufacturers would be well advised to bear in mind.

One reflection with which the contemplation of the accounts and directorial reports of these London electric lighting companies inspires us is the conclusion that, so far as can be seen at present, the revenue-earning capacity of such undertakings is hardly likely to approach that of gas companies similarly situated. Sir John Pender is of opinion that the existing plant and resources of the Metropolitan Company are equal to the supply of 300,000 lamps of 8-candle power. At his own figure, this would mean a revenue of about £127,000 per annum, earned for a capital expenditure of (say) about £650,000. This is a ratio of income to capital of 19·5 per cent. The ratio in the case of all the London Gas Companies taken together is 31·3 per cent. Some allowance must, of course, be made for the different ages of the two kinds of lighting business. But it is a fair conclusion, from the figures as they stand, that the dividend-earning capacity of a sovereign employed in the gas industry is likely to remain a long way ahead of the corresponding productiveness of an equal coin sunk in electric lighting. A company engaged in the latter business will be able to pay a fair dividend with an annual revenue of upwards of 15 per cent. on the capital employed; but there are plenty of such concerns in the country which seem to have little prospect of a gross revenue of half this proportion.

THE TRANSACTIONS OF THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

The publication of the annual volume of Transactions of the Incorporated Institution of Gas Engineers is an event of sufficient importance in regard to the addition it makes to the technical literature of the gas industry to call for special notice here, for the benefit of the large number of engineers and students of gas manufacture who would not otherwise become acquainted with the character of the contents of the volume. We are glad to be able to testify to the success which has rewarded the efforts of the Council of the Institution to keep up the high standard of their official publications, and to state that the present volume—the fourth of the series—like the earlier ones, is indispensable to all who would keep a record of the best contemporary work in the various branches of the gas industry of which it treats. It is unnecessary for us to discuss again the matters dealt with in the Presidential Address and the papers read at the general meeting, since these were fully reported and commented upon in the JOURNAL at the time. The memories of regular readers of technical periodicals are short, however; and especially nowadays, when the bulk of technical literature is so great, it is no easy matter to keep in mind the origin and merits of even the most valuable memoirs which mark the progress of a cause in which one is ever so closely interested.

Recent circumstances endow with particular interest the first paper in the present volume—by Mr. George Livesey, on the "Relations of Capital and Labour in Gas-Works," in which the author has the following pregnant passage: "I am convinced that the future prosperity of industrial life, and proper relations between capital and labour, lie in this direction (the extension of the principle of partnership); and it is the duty, and happily to the interest and advantage also, of employers, to take as their guiding star a real and effective partnership with their workers. The process must necessarily be slow and gradual; the workers have so long been in the position of children, that they have had practically no experience in commercial life or in the management of the various industries by which they live—in fact, they know nothing on these points. They are, however, willing to learn, if employers will give them the opportunity, *to which the first step is a sharing of profits*." All the world now knows what in Mr. Livesey's opinion is the second step in this direction; but it is interesting to remark how, more than a year ago, he disclaimed finality for the steps that had been so far taken, under his guidance, by the South Metropolitan and Crystal Palace District Gas Companies.

The valuable paper by Mr. S. Meunier, on the "Gas-Works Extensions in Stockport," is rendered more valuable still in this record, by being accompanied by eight folding plates of working drawings. The large and numerous plates constitute, indeed, the glory of these Transactions, and amply justify the great pains and expense which their publication in this form must have entailed upon the Institution. To the already published papers and drawings, is appended a communication on the "Analysis of Coal Gas from Various Districts," by Mr. E. Llewellyn Pryce. These analyses were made, according to the author's statement, primarily with the object of ascertaining whether the "dip" or "anti-dip" system of taking off the gas from the retorts was the more likely to favour the introduction of nitrogen. It is satisfactory to learn that, with either system, the percentage of nitrogen can be kept down to a very low figure. The author is of opinion that coal gas derives but a trace of its nitrogen from the coal; the remainder being acquired from the atmosphere. Mr. Pryce has also worked upon the lines suggested by the late Professor Foster, with the object of ascertaining the illuminating power of the different samples from their chemical composition, but without success. A novel observation by this author refers to the small proportion of carbonic oxide in London common coal gas, as compared with some provincial gas; and it is remarked upon this that evidently a large percentage of carburetted water gas could be added to the former without unduly raising the quantity of carbonic oxide in the gas as supplied to the consumers. Of the abstracts of papers published in various chemical journals, &c., included in the Transactions, there is not much to be said. They are not calculated to impart a notable amount of additional information to habitual readers of the JOURNAL. Some surprise may be expressed at the fact of the Abstractors for the Institution having gone to a translation published in the *Journal des Usines à Gaz* for the matter of the Report of the Commission on Photometry appointed by the Association of Dutch Gas Managers. There was surely no need to read the Dutchman's report through French spectacles—which are seldom reliable for such a purpose—when it was possible to have a direct abstract made, as was done for the JOURNAL.

A most important addition to the Transactions is Mr. F. S. Cripps's bibliography of British and Foreign gas literature, which is stated to be the first part of a complete list of all the published literature on gas matters throughout the world. In his "Explanatory Preface," as he calls it, with a touch of adjectival superfluity, the compiler tells how he had long been impressed with a sense of the desirability of having a complete list of all that has been published on gas matters, from the earliest days of gas lighting to the present time; and how, in

spite of the difficulties of the task, he set about supplying the need himself. The gas industry at large, and the members of the Institution in particular, should feel immensely obliged to Mr. Cripps for his trouble. His list—which is also published as a separate and convenient book, with spare leaves for manuscript additions—is by far the best thing of the kind that has ever been offered to the technical public; and he must have taken an enormous amount of trouble with it. He has classified the works under a variety of headings; and not the smallest of his difficulties must have been that of "drawing the line," to the inclusion of some works and the exclusion of others of almost equally pertinent subject matter. The attendant evil of classification—separation—has been corrected by the addition of a complete Index of Authors, alphabetically arranged under their respective countries, which is very convenient. Painstaking as Mr. Cripps is in everything he undertakes, it is evident that his collection could not have been made so complete without the co-operation of many well-informed helpers and correspondents, whom he is rightly careful to name and thank for their assistance.

With a prudent sense of the just limitations of a compiler of such a list, Mr. Cripps has not attempted to do more than refer to the indexes of technical periodicals and the Transactions of various societies. As he admits, much of the most valuable information on gas matters is to be found in publications of these classes; but it was beyond his scope to deal with their indexes in the same way as he has treated independent works, and others which are liable to be lost sight of through their casual appearance in magazines and journals which only occasionally refer to gas matters. One observation we shall permit ourselves to make upon the scheme of Mr. Cripps's work, which he may or may not think fit to remember when preparing another edition. He admits that "many of the earlier works are out of print; and in some instances they are very rarely to be met with." In such a case, it would be a help if it were to be stated where the works are to be found, if any copies remain available for public reference. Again, there is little assistance to be derived from the bare statement of where a work was published, unless the publisher's name is also included, or information given as to where copies of the work can be had, if it is still in print. As to the latter eventuality, of course there must always be a certain vagueness; but wishful purchasers might at least have an opportunity of making an application to the proper quarter at their own risk.

The question of the inclusion of trade catalogues probably exercised Mr. Cripps's mind; but if he saw the advisability of making some reference to German and American publications of this kind, he might have done the same for English ones on similar grounds. In one or two places, Mr. Cripps is hardly up to date; and some of his personal references are slightly misleading. He confesses to the possible perpetration of omissions and inaccuracies, which are, indeed, inevitable in the case of first publication of such a compilation. But we have found very few; the work being, on the whole, surprisingly well done. By far the greatest drawback to the usefulness of Mr. Cripps's work is his already-mentioned, altogether unaccountable reserve in regard to publishers' names. We took the trouble to look up on our own bookshelves several of the works he mentions, only to find, as we expected, that they came from as many different publishing firms, and could not have been procured from his direction by any bookseller. Of many of his entries, it is impossible for us to find any trace. This is absurd; for either Mr. Cripps wishes people to find their way to books by his help, or he does not. If he does, he must make the way plainer; if he does not, let him leave out his worthless and irritating repetitions of "London," "New York," and so forth, altogether. He may be recommended, in this connection, to look at the way this kind of indexing is done by the American *Engineering Magazine*, to be seen at the Patent Office Library and elsewhere. In this index, unnecessary repetitions referring to the source are saved by the use of significant initials, the meaning of which is given in an accompanying table; and the length of the article is also stated. If a job of this kind is worth doing, it is worth doing well; and it is not creditable that a monthly technical index, which must be got up in a hurry, should tell more to the inquirer than a compilation professedly meant to possess permanent value. Mr. Cripps should really see to this, if his second edition is to be regarded by practical men as worth printing.

Mr. A. F. Goodson, the Manager of the Heckmondwike Gas Company, has been presented, at a banquet given by him to the whole of the winter staff, with a gold seal and a meerschaum pipe, as a token of their esteem and affection. A resolution was passed thanking the Chairman (Mr. J. Stead), the Directors, and the Manager for their kindness to the workmen.

Death of Mr. John Taylor, of Rastrick.—The sudden death is announced, as having taken place last Wednesday, of Mr. Alderman John Taylor, of Rastrick. The deceased gentleman, who celebrated his seventy-sixth birthday the previous Friday, was one of the promoters and the Secretary of the Rastrick Water Company—an undertaking that passed into the hands of the ratepayers a few years ago; and at the time of his death he was a Director of the Rastrick Gas Company.

A NEW FEATURE IN PREPAYMENT METERS.

Of the patenting of automatic prepayment gas-meters there is no surcease; and a respectable selection of these interesting appliances are actually upon the market. As specimens of these most ingeniously-constructed articles are brought under notice one after another, and the manifold excellencies and safeguards pointed out by the proud proprietors, we are moved to esteem every one cleverer than the rest, and to think of the last and newest that surely the culminating point of certainty, adaptability, and security has in it been attained. We refrain from confessing how often this latter conviction has been forced upon us; but it happened again last week, when we had an opportunity of inspecting the specialty of the National Meter Company, Limited, which is the happy result of the inventive labours of several partner-patentees. The time has come now when the introducers of yet another penny-in-the-slot meter can fairly be asked whether there are any special points about their production, or whether it is a mere manufacturer's device for "keeping up with the procession" of the trade, which now includes an automatic prepayment meter attachment among those business necessaries which no "live" firm can afford to be without. There are in mechanics usually so many different ways to be made out for doing the same thing, that various parties can cultivate methods of their own without necessarily interfering with one another. The time soon arrives, however, when patentees discover that there is no further demand for appliances which are no better than, but only different from other arrangements having the same object; and this is emphatically the case in regard to automatic prepayment meters.

In the instance of the National Meter Company's specialty, the first thing to strike one is that, besides being a penny-in-the slot meter, it is a half-penny-in-the-slot meter also; duly measuring out for the smaller copper coin exactly one-half of the quantity of gas purchaseable by the larger circulating medium. This may appear at first sight a small matter; but it really is a consideration competent to turn the scale in favour of the meter possessing it, as compared with others equally good in other respects, but of less accommodating appetite. For, after all, people who are in the habit of making their purchases for copper, or, as the police more correctly have it, "bronze coins" of the realm, carry both pence and halfpence; and it is apt to irritate anyone to find that a mere mechanical appliance refuses, unlike any other chandler, to take two half-pennies as the equivalent of a penny, or to sell a ha'porth to a poor man who for the nonce has no more money in his pocket. Wherefore we regard the National Meter Company as having distinctly scored with their penny and halfpenny receiving mechanism. And there is more in the elasticity of the arrangement than this; for by a very simple modification, the same principle can be adopted to work with shillings and sixpences. Further than this it seems impossible to go at present with English coins, for the sufficient reason that the current florin and the penny are so nearly of a size that the machine could not discriminate between them. For any currency, however, presenting a marked graduation of size from the dollar downwards, there would be no difficulty in so adapting the meter under notice, as to enable consumers to pay for gas with any coin they happened to have in hand at the moment.

In this meter, the prepayment mechanism is conveniently placed in front, without adding to the height, or interfering in any sense with the pipe connections. At the bottom is the money-box, which is of considerable capacity; and the ordinary index is not touched by the prepayment attachment. Mounted horizontally over the ordinary index, there appears in view the front edge of a porcelain ring 3 inches in diameter, bearing 200 separate divisions in plain black lines; each division representing a cubic foot of gas. The consumer helps himself to gas by turning, through an eighth of a circle, a milled brass knob, which reveals a slot, into which he drops his penny, and turns the knob back again. By the same movement, the penny is released, and falls into the cash box, and the porcelain ring turns from right to left; a fixed pointer in the front showing how far it has turned, and indicating the number of feet of gas purchased by the transaction. This ring is attached directly by a rod to an inlet-valve, and, by means of a rod and pinion geared to the crank-shaft of the meter, is revolved in the reverse direction to that given to it by the penny—that is, it returns towards its zero point with every cubic foot of gas burnt, the exact state of the account being always visible at a glance on the wheel.

Any error of adjustment of quantity to price, is apparent at once when the meter is set, and can be rectified immediately. The adjustment mechanism is so sensitive as to permit of the most minute change, which is effected by means of a milled headed screw. Two hundred cubic feet of gas may be prepurchased; but it is only the first coin, and the last few feet of gas, which have any effect upon the valve. The first coin opens it to the full extent, when it becomes disconnected with the rest of the mechanism (thus preventing risk of premature closing) until the allotted quantity of gas is nearly consumed, when it again comes into operation, and gradually closes. The valve is made wholly of incorrodible metal; and it is subjected to three influences tending to keep it shut—its own weight, the motion imparted

by the meter, and the gas pressure—so that it is next to impossible for it to fail or get out of order. But supposing the worst to happen, and the valve to fail of its duty, the extra quantity of gas passed would appear in evidence, not only on the ordinary index, but also on the prepayment indicator, and would be automatically deducted from the next purchase.

Another feature of this meter is the precaution taken to prevent jamming by the careless insertion of a second coin in the slot before the first has been cleared. This is done very simply, by making the coin instantaneously close and lock the slot over itself until it has been discharged. The same stop comes into play when 200 cubic feet of gas have been prepurchased; thereby preventing the insertion of another coin until at least one pennyworth has been consumed. The last, but not least, point to be noticed is the very simple and strong character of the prepayment attachment and gear. As already remarked, it has no connection with the ordinary meter-index; and however roughly the coin-receiving mechanism may be handled, no strain can come upon the internal fittings. Every part is made to gauge, and is interchangeable; and the whole thing can be taken away by turning a screw, when the meter can be used as an ordinary gas-measuring instrument.

The Tiverton Appointment.—Mr. William Littlewood, lately Manager of the West Bromwich Corporation Gas-Works, was last Wednesday unanimously appointed Manager of the gas-works at Tiverton, recently acquired by the Corporation. There were 87 applicants; and, after consideration by the Lighting Committee, two appeared before the Council, with the result stated above.

The Gas Managership at Wakefield.—On Tuesday last, Mr. Harry Townsend, who in January resigned his appointment of Engineer and Manager of the Plymouth Gas Company, was selected, from among 67 applicants, for the position of Manager of the Wakefield Gas Company, in succession to Mr. J. W. Whitaker, deceased. Mr. Townsend, who was nearly five years at Plymouth, was formerly for some six years at Dewsbury; and before that, again, at the Thornton Road Gas-Works of the Bradford Corporation. The Directors of the Company chose six of the applicants for personal interviews; and after two days of careful consideration, they determined upon giving the position to Mr. Townsend.

The Wallasey Gas and Water Works Appointment.—For the position recently advertised in our pages, on the resignation of Mr. H. Ashton Hill of his position of Engineer and Manager of the Wallasey Gas and Water Works, 94 applications in all were received. A Sub-Committee cut down this number to ten; and these gentlemen waited upon the General Committee on Thursday, the 18th inst., when the list was still further reduced to three. The final selection was then made of Mr. J. H. Crowther, who has been engaged at the Wallasey Gas and Water Works for about 3¼ years, in connection with the construction of the new gas-works. He was previously at the Nottingham Corporation Water-Works, and has had charge of extensions at various gas-works throughout the country. Mr. Crowther, who is 32 years of age, took up his new duties the day after his appointment.

The Resignation of Mr. J. Hepworth.—The staff and workmen of the Carlisle Corporation Gas and Water Works, to the number of 180, were entertained at dinner last Thursday by their retiring chief, Mr. J. Hepworth. During the evening, Mr. Clarke, on behalf of the employees, presented an illuminated address to Mr. Hepworth, and a gold bracelet to Mrs. Hepworth. The address set forth the regret the workpeople felt at losing Mr. Hepworth, and alluded to the extensive improvements which had been inaugurated during his term of office, including the dining and reading rooms, the library, and the benevolent fund. Mr. Hepworth responded in suitable terms; and his health was afterwards pledged with musical honours. On the previous evening, the members of the Charlotte Street Church presented Mr. Hepworth with an easy-chair, upholstered in morocco leather.

Water-Meter Experience in Detroit.—The meter system of water supply was introduced in Detroit in 1889, and was followed at once by a marked diminution in the consumption. This has since been continued, as evidenced by some interesting figures contained in the report for the past year, lately issued by the General Superintendent of the water supply (Mr. L. N. Case). We find that, in 1888, there were 36,863 families supplied; the quantity of water pumped being 14,380,166,670 gallons, or at the rate of 390,008 gallons per family. In the following year, 39,158 families were supplied, the water pumped being 12,875,334,453 gallons, or at the rate of 328,880 gallons per family. In 1890, the families numbered 41,467, and the quantity of water pumped was 12,120,944,532 gallons, or 292,300 gallons per family. Last year, the families had increased to 49,912, yet the pumping only reached 13,649,779,605 gallons; being at the rate of 273,476 gallons per family. The total consumption in 1894 was practically the same as in 1887, when the population was 184,830, or 74,000 less than last year. This reduction in pumping has not been brought about by any increased expense for water to consumers, as 95 per cent. of the metered supplies pay less than under the assessment plan; the average expenditure per family falling from $9·39 in 1889 to $8·39 in 1894.

NOTES.

The De Mare Incandescent Gas-Burner.

Public attention is being given in Paris to a system of incandescent gas lighting to which the name of the inventor, M. De Mare, has been given. The arrangement consists of an atmospheric burner-fitting designed to be easily attached to an ordinary burner point. This fitting is of extremely ingenious design and construction; being probably the smallest and most compact air and gas mixing apparatus ever successfully used for this purpose. It is professedly designed upon the principle of the Giffard injector. The mixed gas and air issue at the top of the fitting through a slit, which causes the flame to spread in the regular batswing shape. Across this flame is suspended, by means of a brass yoke, a length of twisted platinum wires, carrying a row of what appear to be asbestos fibres. In the heat of the atmospheric flame, these fibres become highly incandescent, and yield a brilliant light. The effect is certainly striking; and as neither chimney nor globe is required to enable the light to burn satisfactorily, and the incandescing material is not woven into any textile form, the simplicity and cheapness of the arrangement are obvious. For street lighting, clusters of these burners are used in Paris with good effect. Before lighting, the fibres, being flexible, will stand any reasonable amount of handling; and it is said that one string will last for 1500 hours of lighting, and be serviceable to the last shred. The consumption of gas in the De Mare burners is limited to 2¾ cubic feet per hour; and the illuminating power is stated to be 25 candles.

A Central Station Heating System.

A variant on other systems of central station heating in use in America is the Yaryan plant, called after the originator, and worked in connection with an electric lighting station at Toledo. In several other places, attempts are made to utilize the exhaust steam of electric light engines, which involves either constant running, or the admission to the distribution system of live steam from the boilers during periods when the engines are shut down. By Mr. Yaryan's plan, the exhaust steam is caused to heat up the water in a large tank well protected from radiation; and this water is turned into the circulating-pipes when the engines are not at work. The supply-pipes are laid 3 feet below the level of the street; and they are boxed in, and covered with non-conducting material. The water leaves the central station at a temperature of 180° Fahr., and returns at a temperature of 140° Fahr. when the outer air is at zero. The mains extend to a length of 10,980 feet; and the water is forced through them under a pressure of 35 lbs. at the pumps, after the rate of 328 feet per minute. During last winter, 27 houses were heated—it is claimed successfully—in this way; the average internal temperature being maintained at 70° during zero weather, which is the normal American requirement.

Wind Pressures.

In an article upon wind pressure, contributed by Mr. W. H. Bixley to an inquiry instituted by the engineer staff of the United States Army into the limitations of suspension bridge construction, it is stated that English practice to-day in regard to allowance for wind pressure on structures is presumably in accord with the rule that the maximum wind pressure in any locality is given by the formula $p = 0{\cdot}01v^2$, in which v = the velocity of the wind, as shown by the records of the ordinary cup anemometer; and in the most exposed places, to allow for 56 lbs. per square foot of wind pressure over from 1·0 to 2·0 times the effective area of one bridge-girder. In France, the practice presumably is in accord with the rules laid down by the text-books of the Ponts et Chaussées, which estimate the wind velocity of storms at 100 miles an hour, and allow for pressures up to 60 lbs. per square foot over the effective area of one truss of a solid truss bridge, or of 1·5 trusses of an open-work truss bridge. Mr. Bixley remarks upon this, that these allowances seem more than is necessary for long bridges, especially in view of the fact that so many bridges with so much less bracing than these would call for have stood so well for years. One such bridge, cited by Shaler Smith, although only calculated for a 30 lbs. wind pressure, stood safely even when one of its spans was actually crossed by the very centre of a tornado. In American practice, 30 lbs. is taken as the wind pressure upon large surfaces, and from 40 to 50 lbs. for small surfaces and unloaded bridges.

Vulcanized Timber.

The interest of the coal tar and creosote trades in the new wood-preserving process of Colonel S. E. Haskin, recently introduced into this country, is very close; for if the claims made for this system are substantiated, a considerable change will inevitably come over the creosote market. Hitherto the creosoting of wood has been admitted to be the best way of preserving it for many purposes, but the process has its obvious drawbacks. By the Haskin system, the wood is simply cooked in closed vessels, under considerable pressure, at a temperature of from 300° to 500° Fahr. In this way, it is claimed that the perishable constituents of the wood are coagulated *in situ*, and that everything in and about the wood that possesses commercial value—colour, odour, capability of being tool-worked, and strength—remains just as before treatment. Indeed, the strength of the

treated sample is stated to be increased. The wood may be taken in the green state, with all the sap in it, and rendered incapable of absorbing further moisture, or of rotting through exposure to air and damp. The process is called "vulcanizing" the wood—not very appropriately, for it does not at all resemble the treatment called by the same name to which india-rubber is subjected. If all these claims are justified, the saving of time alone in the seasoning of timber should render the process a favourite one with dealers. Whether it really does preserve timber so well as creosoting, is, of course, a question that time alone can answer.

Efflorescence on Brickwork.

The subject of the efflorescence upon new brickwork, has recently been freshly treated in the *Builder*, which journal engages, moreover, to analyze and report upon any samples of this plague of green brickwork that may be sent to the office for the purpose. So far as the subject has yet been investigated, it is certain that the incrustations in question are of many kinds, and due to various causes. Bricks have been observed to "effloresce" in one situation, and not in another. In the same building, also, the incrustation may be fairly permanent for years; while in another it may be only of a temporary character, but reappearing at intervals. Different sides of the same building may be affected in different degrees. All possible combinations of circumstances have been blamed for this effect. Our contemporary is of opinion that the character of the atmosphere has something to do with it, as well as the prevailing winds. In at least two instances that have recently come under notice, the incrustation was of a vegetable nature, and was, in fact, mould. Generally, however, it is of mineral origin. In the latter case, it may be quite superficial in character, rapidly formed and easily washed away by a shower of rain; or it may be of a more serious kind, corroding the surface and apparently entering into the composition of the brick, when it is very difficult to get rid of. Mortar may or may not have something to do with the phenomenon; but that it is not confined to the action of anything contained in mortar, is proved by the fact that it sometimes appears on bricks before leaving the maker's yard. Vitreous and hard-burnt, non-porous bricks appear to be the least susceptible to this disfigurement; but even here exceptions might be found.

COMMUNICATED ARTICLE.

THE DETERMINATION OF SULPHURETTED HYDROGEN AND OTHER IMPURITIES IN COAL GAS.

By J. T. Sheard, F.C.S.

Some years ago, I described in the JOURNAL a new process and apparatus (which has since been somewhat extensively employed) for determining the amount of carbon dioxide existing in crude or in partially purified coal gas.* At the time, I stated that the apparatus was equally serviceable for determining ammonia, and that I hoped to devise a method of rendering it applicable to the determination of sulphuretted hydrogen, so that the three principal removable constituents might be estimated in the same sample of crude gas. I have recently given the subject renewed attention; and after experimenting in various directions, and experiencing many failures, I now submit the following as answering the requirements, and furnishing a simple yet quite accurate method of determining the amount of sulphuretted hydrogen *pari passu* with the other impurities.

Briefly stated, the method I am about to describe is founded upon the reaction which occurs when sulphuretted hydrogen is passed into an aqueous solution of cupric sulphate (blue vitriol). A precipitate of cupric sulphide is formed, and sulphuric acid remains in solution, thus:

$$CuSO_4 + H_2S = CuS + H_2SO_4.$$

The solution, which previously was neutral, has now developed an acid reaction; and the amount of free sulphuric acid found represents an equivalent amount of sulphuretted hydrogen absorbed and fixed by the copper. This amount can be determined by simple titration of the clear liquid (after filtering out the precipitate) with a standard alkali solution.

A solution of convenient strength is made by dissolving one part of recrystallized cupric sulphate in ten parts of distilled water. About 30 c.c. of this solution, contained in one of the absorption-tubes (see previous article, *loc. cit.*), is sufficient to absorb the whole of the sulphuretted hydrogen ordinarily contained in 500 c.c. of crude gas. For the subsequent titration of the exposed liquid, I employ a solution of ammonia of one-twentieth normal strength, each c.c. of which therefore contains ·00085 grm. NH_3. Any ammonia contained in the gas to be tested, must be removed before it reaches the copper solution; and, as any carbon dioxide passes forwards, it is convenient, as well as an advantage, to estimate the three constituents at one operation. An example will make the process clear to those familiar with the apparatus as employed for carbon dioxide. Other readers are referred, for details of manipulation, to my former article.

* See JOURNAL, Vol. L., p. 240.

For the determination of ammonia, sulphuretted hydrogen, and carbon dioxide in the gas at the outlet of the first scrubber, four absorption-tubes were employed. The first (for ammonia) contained 20·8 c.c. of $\frac{N}{20}$ sulphuric acid; the second (for sulphuretted hydrogen), about 30 c.c. of cupric sulphate solution; the third and fourth (for carbon dioxide), 30 c.c. and 20 c.c. respectively of barium hydrate solution. A filter-tube, containing cotton wool well saturated with the crude gas, was interposed between the apparatus and the gas supply, to arrest tarry matter. After connecting up, and finding the connections sound, 500 c.c. of gas were drawn slowly through the apparatus, followed by 1000 c.c. of air, to drive the gas through the whole series of bulbs. The apparatus was then removed for purposes of analysis.

The glass scrubber of each absorption-tube was washed down with a little distilled water. The contents of the second tube were then transferred to a filter, and the filtrate and washings collected. To the latter, two or three drops of methyl-orange were added; and then $\frac{N}{20}$ AmHO was run in from a burette, until the colour of the liquid changed to a clear lemon yellow, showing that neutralization was accomplished. The contents of the first tube, which had absorbed ammonia, were titrated with the same solution; cochineal being employed as the indicator. Methyl-orange may take the place of cochineal; but the latter gives a much sharper colour-change with ammonia. Cochineal is not, however, applicable with the copper solution. The tubes which had absorbed carbon dioxide were titrated with $\frac{N}{10}$ HCl in the ordinary manner.

Each cubic centimetre of $\frac{N}{20}$ acid that has been neutralized in the first absorption-tube, represents 74 grs. of ammonia (NH_3) per 100 cubic feet of gas; and each cubic centimetre of $\frac{N}{20}$ ammonia required to neutralize the acid found in the second absorption-tube, represents 74 grs. of sulphuretted hydrogen (H_2S) per 100 cubic feet of gas.

In the example given—

First Absorption-Tube.

	Cubic Centimetres.
$\frac{N}{20}$ H_2SO_4 taken	20·8
$\frac{N}{20}$ AmHO required to neutralize .	19·5
NH_3 absorbed =	1·3 × 74 = 96 grs. of ammonia per 100 cubic feet of gas.

Second Absorption-Tube.

$\frac{N}{20}$ AmHO required to neutralize .	9·4 c.c. × 74 = 696 grs. of sulphuretted hydrogen per 100 cubic feet of gas.

Third and Fourth Absorption-Tubes.

	Cubic Centimetres.
Equivalent of $\frac{N}{10}$ BaHO taken .	46·2
$\frac{N}{10}$ HCl required to neutralize . .	37·6
CO_2 absorbed =	8·6 × 0·24 = 2·06 vols. per cent. of carbon dioxide.

The whole experiment does not occupy more than three-quarters of an hour; and, if carefully performed, the results may be relied upon as quite correct.*

It will be obvious that one reagent may be dispensed with, if hydrochloric acid of half decinormal strength be employed for absorbing ammonia, and also for titrating the barium hydrate.

Death of Mr. N. J. Ginman.—A cablegram from Port Louis announces the death, on the 18th inst., of Mr. Nicholas J. Ginman, Manager of the water-works near Port Louis. For about six years, Mr. Ginman held the position of foreman of works in the Water Department of the Halifax Corporation; having previously occupied a similar situation under the Bradford Corporation. About eighteen months ago, he left Halifax to take the situation in the Mauritius. The deceased gentleman was 42 years of age. While at Halifax, he invented an appliance for testing leakages.

Mr. John Mitchell, J.P., M.Inst.C.E., of Bolton-upon-Dearne, died on the 18th inst., after a lingering and painful illness. Mr. Mitchell took considerable interest in the introduction of water gas; and after being connected with the British and Lancashire and Yorkshire Water-Gas Syndicates, he became a Director of the Amalgamated Water-Gas Companies. He had also an extensive practice as a mining and consulting engineer; and latterly, in conjunction with his son (Mr. T. W. H. Mitchell), he acted as Engineer to the Dearne Valley Water Company. The deceased gentleman was only 54 years of age.

* Where strict accuracy is required, the amount of carbon dioxide found must be reduced by 0·08 per cent., which is introduced by the 1000 c.c. of air drawn through the apparatus.

TECHNICAL RECORD.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

The Programme for the Forthcoming Meeting.

As already mentioned in the JOURNAL, the annual meeting of the Incorporated Institution of Gas Engineers will take place next week, under the presidency of Mr. C. C. Carpenter, of Vauxhall. It will extend over three days—Wednesday to Friday; the first two being devoted to general business, and the third to an excursion to Brighton. Owing to the structural alterations now in progress at the Institution of Civil Engineers, the meeting will be held at the Royal United Service Institution, Whitehall.

On the opening day, the chair will be taken at half-past ten; and the first business will be the presentation of the following report of the Council (which is signed by the retiring President, Mr. Alfred Colson, and the Secretary, Mr. Thomas Cole), accompanied by the statement of accounts:—

In presenting its fifth annual report upon the work and progress of the Institution, the Council has again the pleasure to state that, both as regards membership and usefulness, its position is steadily improving.

To students, their connection with the Institution affords many advantages; and the Council desires to point out to the members the importance of thus attaching the sympathies of the junior workers in the gas engineering profession.

As promised in the last annual report, there has this year been incorporated with the volume of "Transactions" an "Index to Gas Literature," compiled by Mr. F. S. Cripps. In thanking Mr. Cripps, on behalf of the Institution, for the time and patience expended upon this work, the Council would also express its belief that the value of his "Index" will be fully appreciated by all interested in the science of gas engineering. The "Transactions" already issued continue to command a ready sale—a satisfactory proof of their usefulness.

In its report issued in 1893, the Council recorded the steps taken to bring the views of the Institution before the Committee appointed by the Board of Trade to consider the standard of light. The Committee has now concluded its labours; and there is every reason to believe that most of the suggestions put forward by the Institution have been adopted, both as regards the standard itself, and the method of consuming the gas with which it is to be compared. The investigations of the Committee have been so searching and complete, that the publication of some record of their work cannot fail to prove of the greatest interest. This the Council is pleased to say has been secured in the form of a paper to be read at the forthcoming May meeting by Professor Vivian B. Lewes.

The meeting of the Institution at Leicester, where every possible hospitality was extended to the members, was an unqualified success; and the Council are encouraged to hope for the continued success of these autumn gatherings, affording as they do additional opportunities for the intercourse of members and interchange of their ideas, which were among the objects the Institution was founded to promote.

The presentation of the report and accounts will be succeeded by the election of members; and then the new President will deliver his Inaugural Address. The remainder of the day will be occupied with the reading and discussion of the following papers: "Old-Age Pensions," by Mr. George Livesey; "The Work of the Photometric Standards Committee," by Professor Vivian B. Lewes, F.I.C., F.C.S.; "The Modern Gas-Engine: Its Development and Application," by Mr. G. E. Stevenson; "The Temperatures Employed in the Distillation of Coal," by Mr. Lewis T. Wright. In the evening, the annual dinner will be held at the Holborn Restaurant.

On Thursday, the business will be resumed at half-past ten; the following papers being set down for reading and discussion: "Acetylene and Its Enrichment Value," by Professor Lewes; "Installation of Water Gas at Tottenham," by Mr. A. E. Broadberry; "Sloping Retorts at Brentford," by Mr. J. Husband; "The Manufacture of Sulphuric Acid by Makers of Sulphate of Ammonia," by Mr. Fletcher W. Stevenson; "Purified Ammoniacal Liquor and Its Use in Gas Purification," by Mr. T. Holgate; "The Monnier System of Cement Construction as applied to Gas-Works," by Mr. F. D. Marshall.

On Friday morning, the members will leave Victoria Station at ten o'clock for Brighton. On their arrival, an inspection will be made of the engine and carriage works of the Brighton Railway Company, under the guidance of the Company's Locomotive Superintendent (Mr. R. J. Billinton). They will then drive to the Portslade Gas-Works, where luncheon will be provided by the Directors of the Brighton and Hove General Gas Company; and after this the works will be inspected. They are situated on a strip of land 28 acres in extent, lying between the sea and a canal. They are built in three sections, and are supplied with coal from steamers, which are berthed alongside, and unloaded by means of steam-cranes. The retorts are circular, provided with wrought-iron ascension-pipes, and are direct fired. Two sets of exhausting plant are provided. The first draw the gas from the retorts, and force it through the washing plant to the purifiers, where the second set take up the work, and give the necessary pressure to overcome the weight of the holders. Of especial interest are the various forms of rotary washers, commencing with the one first designed and constructed by Mr. John Birch Paddon in 1870. The purifiers are of large area, and conveniently arranged in commodious houses. Lime is the purifying material used, supplemented in the final boxes by Weldon Mud, which has been in constant operation at these works for several years. From the Portslade works, the party will drive to the Company's gasholder and distributing station at Hove, where Mr. Paddon's system of wind-bracing for gasholder guide-framing will be seen among the features of interest. The return train will leave for town at five o'clock, and Victoria will be reached by half-past six.

ON A PROPERTY OF THE NON-LUMINOUS ATMOSPHERIC GAS-FLAME.

At Burlington House, last Thursday evening, Mr. LEWIS T. WRIGHT communicated to the Chemical Society some account of a peculiar property possessed by the non-luminous atmospheric gas or Bunsen flame. It is generally known that, when the Bunsen flame is supplied with sufficient air, there is developed an inner cone; and that when the supply of air is further increased, the inner cone recedes into the burner-tube. This is what is known as "lighting-back." Before the proportion of air is reached that gives this phenomenon, the gas mixture issuing from the burner, and affording the flame, is already an explosive mixture. But the rate at which the flame can propagate itself in this mixture is inferior to the velocity of the gas current issuing from the burner; and the flame does not enter the tube. When, however, the proportion of air is augmented, the mixture becomes more explosive, and its rate of ignition is increased until with sufficient air supply the rate of flame-propagation becomes superior to the velocity of the gas current in the tube, and the flame enters and lights back. Smithells and Ingle, in 1892, described an ingenious method by which this inner flame could be allowed to enter the burner-tube, and could be made to rest upon the top of an inner tube of smaller diameter, fitted inside the outer or burner-tube; and when this latter is of glass, the inner flame can be seen resting and burning in the inner and lower tube, while the outer flame is burning at the same time on the top of the outer and longer burner-tube. The flame is thus divided into two distinct flames at a distance from each other. The outer flame is composed of the products left by the partial combustion of the inner flame, which find in the atmosphere the oxygen necessary for the complete combustion of the carbonic oxide and other inflammable gases, such as hydrogen and hydrocarbons left unconsumed in the inner flame. It appears that this division of the Bunsen flame was studied by Mr. Wright in 1887, and fully described by him in June of that year in a paper read before the Royal Society. The communication just made relates to a peculiar property possessed by this inner flame.

It is known that, in the case of explosive mixtures formed by such gases as coal gas, &c., and air or oxygen, there are two limits of explosibility—

(1) A lower limit, when the air is in too great excess. In the case of the coal gas employed in the experiments described, the proportion was 10·3 per cent. of coal gas (18·75 candles and ·45 sp. gr., air being 1), and 89·7 per cent. of air.

(2) An upper limit beyond which any further addition of coal gas would render the mixture under the circumstances of the experiments non-explosive. That is to say, that the flame would not enter the tube, but would burn at its exit. The proportion was then 23 per cent. of coal gas and 77 per cent. of air.

Between the proportions of 10·3 and 23 per cent. of coal gas, the flame would fire-back and explode the mixture in the tube.

The phenomena specially dealt with in the recent communication relate to mixtures which approach the upper limit of explosibility, when certain remarkable properties are exhibited. With a mixture containing more than 23 per cent. of the coal gas studied, ignited at the end of a long piece of combustion tubing of ¾ inch diameter, and placed in a horizontal position, the inner cone of the flame protruded slightly beyond the open end of the tube; and as the proportion of gas was diminished, the inner cone flattened, and with about 22 per cent. of coal gas would voluntarily enter the tube, and burn inside at some distance from the outer flame. While the inner flame was thus resting inside the tube, it would voluntarily commence vibrating, which vibration would generally result in a sudden rush of flame down the unignited column of gas. The mixture that was previously indifferent had, under the influence of the vibration, suddenly developed highly explosive properties. This the author calls the "induction of the explosive wave." It is known by the researches of Berthelot and others that with such explosive mixtures there are four stages—

(1) A comparatively slow and steady passage of the flame through the explosive mixture.
(2) A vibratory stage.
(3) The explosive wave or detonating stage.
(4) Followed in some cases by self-extinction of the flame.

In the experiments made by Mr. Wright at the upper limit of explosibility between a range of about 1 per cent. of coal gas in the mixture, the vibratory stage was delayed so as to extend over periods of 1 to 6 seconds; being longer as the mixture more nearly approached the upper limit. Within this narrow

range the inner flame, having entered the tube, would rest, burning steadily, and with sufficient proportion of air would commence vibrating, and initiate and induce the explosive wave stage. The flame, before vibrating voluntarily, could, by shocks or tremors given to the tube, be made to enter into the vibratory stage. As the upper limit of explosibility was reached, this vibratory period was not always followed by the detonating stage; but it would sometimes die away, and could then be restarted into its vibratory condition. If the mixture were more explosive (at about 22 per cent. of coal gas), the vibrations would voluntarily commence; and after a short interval of 2 to 4 seconds, would be followed by the explosive wave or detonating stage. The percentage of gas required, of course, varies with variations in the quality of the coal gas employed. As the upper limit of the inner flame would not voluntarily enter the tube, it might be made to do so in the following manner: By means of a Bunsen burner, the end of the tube could be strongly heated; and the current of gas inside being heated becomes more explosive, and the rate of flame propagation is increased. The inner cone—if at this proportion of gas it can be any longer called a cone—becomes more and more flattened, and may enter the tube with the assistance of the external heating before described. Or it may be made to enter the tube, and separate itself from the outer flame by the operator sharply blowing the flame into the tube. The inner flame at the upper limit can also sometimes be detached from the outer flame by shock, or by agitation of the tube. With the aid of external heating, if the inner flame will not voluntarily do so, it will take up a stationary position in the tube. The inner flame can be made to follow the outside Bunsen flame, and to retreat far into the tube. It sometimes happens that the inner flame so retired into the tube will fly back with a leap to the position it had voluntarily selected. The inner flame, when it is once stationary in the tube, and will remain so without the aid of external heating, will, at the upper limit, remain burning steadily. A trifling alteration in the composition of the mixture, reducing the percentage of coal gas, will, by making the mixture more explosive, render the inner flame more sensitive, and more disposed to enter the vibrating stage, which induces and initiates the explosive wave or detonating stage; and with 1 per cent. less gas than the upper limit requires, will, without delay, run down to the column of gas mixture in the tube, and not display the stationary stage and the vibrating stage in the manner described.

The stationary stage can be thus defined: It is the condition when the rate of flame propagation exactly balances the velocity of the gas current in the tube. When the flame was in the stationary stage, its tendency to travel through the explosive, though apparently non-explosive, mixture is exactly and precisely balanced by the velocity of the issuing stream of gas mixture. In this condition the gas current can be gently increased or decreased. The flame, however, remains stationary; and to do this must change its rate of propagation to always exactly balance the changes in the velocity of the gas current.

The analysis of the combustion products of this inner flame shows that, with the changes in the velocity of the gas current, and, of course, increased quantity of the explosive mixture consumed in the same time, there are changes in the manner in which the oxygen consumed is distributed among the combustion products containing oxygen—viz., CO_2, CO, and H_2O.

The following table indicates how these change with the velocity of gas current:—

Velocity of Gas Current, Lineal Feet per Second.	CO_2. Per Cent.	CO. Per Cent.	H_2O. Per Cent.
0·7	3·6	10·4	15·8
0·7	4·1	10·0	15·3
1·4	4·3	11·1	13·8
1·4	4·4	10·9	14·2
1·4	4·4	9·8	15·0
2·2	5·2	8·8	13·8
2·6	6·2	7·6	13·4
3·5	6·2	7·9	12·8

Thus, with increased velocity of gas current, equal increase in the rate of flame propagation and increased quantity of gas mixture consumed in a given time with consequently higher flame temperature, the carbonic acid distinctly increases, the carbonic oxide decreases, and the water decreases.

The explanation given by the author of the paper is this: When the inner flame is balanced in the tube, it heats a ring of the tube immediately around it. Its tendency to advance outwards under the influence of a gently increased velocity given to the gas current would be checked in the following manner: The layer of gas mixture immediately behind the flame would, if the flame advanced, become more heated by the sides of the tube; and the rate of flame propagation would, in consequence, be increased. If, with decreasing velocity of gas current, the flame retreated further into the tube, it would enter a colder zone of the tube, and its ignition rate would be decreased. What is remarkable is the perfect manner in which the inner flame, once lodged in the tube, adjusts, so to speak, its ignition rate so as to precisely balance the changes in the velocity of the gas current.

Increases of Salaries.—Mr. J. G. Newbigging, the Gas Engineer of the Macclesfield Corporation, and Mr. W. Prince, who fills a similar position under the Stoke-upon-Trent Corporation, have had their salaries raised by £50 per annum.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

The Thirty-sixth Half-Yearly Meeting of this Association was held in the offices of the Newcastle and Gateshead Gas Company, last Saturday. Colonel SADLER, J. P., of Middlesbrough, the President, occupied the chair. There was a full attendance of members.

The HON. SECRETARY (Mr. W. HARDIE, of Newcastle) intimated that he had received a letter from Mr. J. Hepworth, of Carlisle, stating his great regret that he could not be present at the meeting. Also that Mr. Ford, of Stockton, was unable to be present, on account of an attack of influenza. Mr. Penney, of South Shields, who was nominated as Vice-President, was prevented by bereavement from attending.

NEW MEMBERS AND ASSOCIATES.

The following were admitted:—

Members: Mr. Morris, Manager of the Maryport Gas-Works; and Mr. John Johnston, Engineer and Manager of the Workington Gas Company. *Associates:* Mr. Frederick Sterling Newall, J.P., of Birtley Hall Colliery, Durham; and Mr. George Sisson, of the Washington Chemical Works.

THE ADMISSION OF NEW MEMBERS.

The Committee recommended that all future applications for membership should be made at least six weeks before ordinary meetings.

Mr. HERBERT LEES (Hexham) moved the approval of the recommendation, which, he said, would allow of the applications being laid before the Committee at the meeting ordinarily held for making arrangements for the general meetings.

Mr. T. TREWHITT (West Hartlepool) seconded the motion; and it was approved.

THE LATE COLONEL COWEN.

The PRESIDENT said that, before proceeding with the business of the meeting, it was his painful duty to express, on behalf of himself and the Committee—and, he was sure, on behalf of everyone in the Association—the heartfelt sorrow they all felt at the serious loss the Association had sustained by the sad death of Colonel Cowen, who took an active interest in the Association, attended all its meetings, and was, he believed, an original member. He was a gentleman whose soul was full of courtesy and kindness, and was certainly one of the most popular members of the Association.

Mr. T. BOWER (West Hartlepool) moved a vote of condolence with the family of Colonel Cowen. He was sure that the President's words would be endorsed by everyone present. They all knew what an active interest Colonel Cowen took in the Association. His genial presence, it would be remembered, was with them at their last meeting in Durham.

Mr. W. TURNBULL (Alnwick) seconded the motion. Colonel Cowen, he said, was certainly a type of a good member. He was always hearty, and was always willing to give the best advice he could.

The resolution was adopted in silence.

THE PRESIDENT ON GAS ENRICHMENT.

The PRESIDENT then delivered the following address:—

NOTES ON GAS ENRICHMENT.

The absorbing question of the hour—and indeed it has been for some time—is gas enrichment. The continuous cry from gas consumers for more light, and the never-ceasing efforts of gas-makers to produce still cheaper gas, compel the latter to tax every resource within their power to accomplish those widely divergent ends—viz., higher illuminating power without seriously increasing the cost. Cheaper coal, and less gas taken off, will do it, of course. But the first is not always available; and the second not often convenient. A larger yield of gas per ton of coal and the enrichment of its low illuminating power naturally suggests itself to everyone as the readiest solution of the problem—especially in the district covered by this Association, where coal is comparatively cheap.

Whatever value may be attached to oil or carburetted water gas in other districts, I cannot think that either one or the other will ever seriously come into competition with coal gas where there is an inexhaustible supply of good gas coal. The sudden and unexpected advance in the prices of mineral oils, places carburetted water or oil gas out of the running at the present. Taking the value of carburetted water or oil gas at the minimum price of 1s. 2d. per 1000 cubic feet, the present increased cost of the oil necessary amounts to 10d. more than before, making the gas cost 2s. per 1000 feet. The long period of unprofitable returns in the oil trade makes it improbable that there will be an early return to the low prices lately prevailing.

The incandescent burner goes a long way in settling the vexed question of more light, independently of the candle power of the gas used; and there need be nothing more said about the matter, had it not been discovered that rich gas is both better and more economical even with the mantle burners. I assume that good gas will be wanted, notwithstanding the general adoption of the incandescent light; and I want to show that benzol is the best and cheapest, as well as being the most natural, enricher of coal gas. It requires some courage to say this after the brilliant and classic researches of Professor Lewes

on acetylene, which shot athwart the sky of the gas world like a dazzling meteor, paling for the time all our poor attempts at illumination.

I have been asked to say a few words about acetylene. Well, it is a malodorous gas, which all here will have often observed when ordinary gas is burned with insufficient air, as happens when a Bunsen burner is lit at the bottom, or has lit-back, as is often the case with cookers and gas-stoves. It is a very poisonous gas; and owing to its ready tendency to polymerize —*i.e.*, form molecules of hydrocarbons, either multiples of itself or (by deposition of carbon and other rearrangements of its atoms) hydrocarbons of more complex structure, it explodes with the slightest detonation. A percussion cap (for instance), an electric spark, a blow, a point or nucleus of catalytic action, are sufficient to provoke this unstable gas into dangerous action. Great caution will, therefore, be necessary with it should it ever become the auxiliary to illuminating gas that has been so sanguinely predicted for it.

Although acetylene has long been known, and many of its leading properties well understood, it remained to Professor Lewes to show its marvellously high illuminating power, as well as many other striking characteristics noted at the same time by him, which were not observed before. No less astounding than the discovery of the luminosity of acetylene, to my mind, was the source from which Professor Lewes proposes to supply it—viz., carbide of calcium, made by fusing lime and coke in an electric furnace. Calcium carbide, when moistened with water, at once evolves acetylene, and leaves a residue behind of slaked lime. Having got the calcium carbide, the production of gas is simplicity itself; and it is this simplicity that, in my opinion, constitutes one, if not the worst, of the dangers attending the use of acetylene. Conjure up in your minds what might happen at a gas-works with tons of calcium carbide lying about!

The cost of acetylene gas depends on the price of calcium carbide. In all the calculations I have seen, it is assumed that the electric current required for converting the lime and coal or coke into calcium carbide, will be obtained by water power, at a nominal cost, from some natural waterfall. Unless this is possible, and the electricity has to be obtained by steam power and the dynamo, the cost will probably be two or three times more than the figure that has been mentioned, which would place acetylene beyond the reach of purveyors of light at a reasonable price, notwithstanding its remarkably high luminosity. It is stated that the electric energy required to produce calcium carbide is capable of yielding four times more light in incandescent electric lamps than can be obtained in the form of acetylene gas from the calcium carbide. If this be so, where is the advantage of converting the electric current first into calcium carbide, and then into acetylene, when it might be utilized vastly more economically by direct application? I am satisfied that, should calcium carbide ever be produced on a commercial scale, its cost will far exceed the estimates given; and, although it may not prevent its use as an illuminating agent, where expense is no object, it is unlikely to compete, or be available to mix, with coal gas.

I am not at all sure that acetylene cannot be made from benzol, by what is known as "cracking," much cheaper than by the process just mentioned. I shall refer shortly to the relationship between acetylene and benzol.

There is no denying the extraordinary illuminating power of acetylene *per se*. But, owing probably to its endothermic character, when burnt (a property it appears to possess in a remarkable degree), it absorbs heat on decomposition, instead of evolving it, as is more generally the case with hydrocarbons. When mixed with ordinary coal gas, it does not yield that increase in light which its addition might lead us to expect. On the contrary, an enormous loss of light apparently takes place, probably from the absorption of heat by the combustion of acetylene, and the consequent lowering of the temperature of the flame.

It is disappointing to find an illuminating agent so full of promise handicapped by so many objections and difficulties in the way of its application. I claim for benzol practically the same illuminating value as is possessed by acetylene; and, speaking from a chemical point of view, there is good reason for the assumption.

Acetylene consists of two atoms of carbon and two atoms of hydrogen; and benzol is constituted of three molecules of acetylene, six parts of carbon, and six parts of hydrogen. Benzol contains exactly the same percentage composition of carbon and hydrogen as does acetylene. Let me make myself clear. The formula for acetylene is carbon 2, hydrogen 2. The atomic weight of carbon is 12, of hydrogen 1. Multiplying them by two, we find the molecular weight of acetylene is 26—*i.e.*, 24 of carbon and 2 of hydrogen. Now 100 parts of acetylene therefore contain in round numbers, carbon 92 parts, hydrogen 8 parts. The composition of benzol is: Carbon, 6; hydrogen, 6. When calculated out in the same way, the molecular weight of benzol is 78, consisting of 72 of carbon and 6 of hydrogen. Therefore 100 parts of benzol contain roundly: Carbon, 92 parts; hydrogen, 8 parts—precisely the same as acetylene. If benzol is split up into three equal parts, each part would be C_2H_2, which is acetylene. The luminosity of flame depending, as it does, on the carbon in the gas, it is reasonable to expect that benzol, having the same percentage of carbon as acetylene, will give an equal illuminating power.

A good deal has been written and said about benzol as an enricher; and, although the subject is well worn, it is one of never-failing interest. Allowing that it may be stale information to many of you, I venture to recapitulate briefly some of the statements lately made respecting it. Ordinary coal gas—say, 15 to 16 candle quality—rarely contains more than 2 per cent. of benzol. It is to this comparatively small relative constituent that gas owes at least two-thirds of its lighting power. I cannot impress this fact too strongly upon you. Let me show you that this is the case. By passing this excellent Newcastle gas through a mixture of nitric and sulphuric acid, the benzol combines with the nitric acid, forming dinitro-benzol; and the gas is afterwards seen to have lost most of its original illuminating power. In contrast, I pass this same denuded gas over cold benzol; and the illuminating power is not only at once easily restored, but a flame of the brightest intensity appears.

Dr. Bunte, a German chemist, who has made gas enrichment a special study, declares that gas will carry 3 per cent. of benzol at the freezing point of water (32° Fahr.). After eighteen months' continuous use, he asserts benzol to be the cheapest and best enricher of gas. He has devised an ingenious apparatus by which the feed of benzol into a small scrubbing column, up which the gas ascends, is regulated to the requirements of the gas, by displacement of the benzol from the store-tank with water—a simple and handy contrivance, almost automatic in its working.

Dr. Schilling, in an interesting paper read before the German Gas Association recently, says his initial experiments with benzol for carburetting were so successful that it was definitely adopted at Munich more than twelve months ago; all the gas produced at the several works of that large city being benzolized during that period with the most satisfactory results, working smoothly, uniformly, and with gratifying success.

He gave some interesting and, I admit, astonishing figures—viz., that he could add 4 to 5 candles to the gas with 600 to 700 grammes (roughly 1½ lbs.) of benzol, say one-sixth of a gallon; and that this was permanent at ordinary temperatures. After protracted refrigeration, at 32° Fahr., an analysis of the gas showed it still held the benzol in diffusion. At 77° Fahr., gas would hold four times as much benzol as at 30° Fahr. He advocates enriching about one-twelfth, and mixing with the rest. I disagree with this. The more gas passed through the benzolizer, the better.

I have drawn a rough sketch of a benzolizer, which is simple, costless, and effective. You will observe that the gas passes over the cold surface of the benzol. The bye-pass arrangement can be adjusted to pass as much or as little gas through as may be desired, so that more or less candle power can be added at will, without any heating arrangement, if sufficient surface for evaporation is allowed for the benzol.

Schilling calls attention to the chilling benzol suffers by its rapid evaporation. He recommends slightly heating to 70° and 80° Fahr., to counteract the refrigerating effect produced by vaporizing the benzol. This is unnecessary, except in very cold weather. He refers to the utility of benzol in the gas in preventing the deposition of naphthalene. Schilling also confirms in every particular Dr. Bunte's statements as to the value of benzol as a carburetter.

Mr. Charles Hunt, of Birmingham, who has had a long and wide experience in the manufacture of gas—whose opinion commands attention, and is moreover much respected by gas scientists—states that, having made crucial trials, one gallon of benzol enriches 9500 cubic feet of gas 1 candle, while one gallon of petroleum spirit only raised 2800 cubic feet. Dr. Dvorkovitz has made some exceedingly valuable communications on this subject; and, while naturally favouring his own oil-gas process of enrichment, he confirms the Bunte, Schilling, Ries, and others' evidence *re* benzolizing gas. Mr. Lewis T. Wright, in a critical way, credits benzol with 40-candle power per cubic foot—that means 200 candles per 5 feet. The champions of acetylene claim not much more; and, if I am not mistaken, there is no cause to complain, as it will be found that the luminosity of acetylene does not much exceed 200 candles, as a matter of fact. Mr. Forbes Carpenter, an authority, commenting on these results, does not dispute the German experts' figures. Professor Frankland, in his investigations on the property of benzol as an illuminating agent, finds that it is equal to 147 candles per cubic foot. Knublauch, an eminent German gas chemist, shows that, under the best conditions, benzol yields 184 candles.

It is difficult to reconcile such discrepancies, emanating as they do from such eminent men, and of undisputed authority on gas questions. It will at once occur to you, as it did to me, that the circumstances and conditions, the modes of testing the constitution of the gas treated, in each case must have been different. The perplexity arising from the conflicting statements I felt was evidently shared by others; for coincidently with an effort to get at the truth of the matter, Mr. Walter King, of the JOURNAL OF GAS LIGHTING, suggested to me the desirability of ascertaining the actual intrinsic value of benzol as an illuminating agent, as had been done with acetylene. Difficulties at once presented themselves. The first one was that benzol is liquid at ordinary temperatures; and, in that form, I have so far been unable to burn it without producing a smoky flame. To compare its illuminating capacity with acetylene, I decided that it must be burnt under the same conditions so far as practicable. Now, as it requires a temperature over 212° Fahr. to

vaporize benzol, and to keep it in gaseous form (an essential preliminary to the trial), the elevation of temperature, of course, applies not only to the reservoir supply, but to the pipes to the burners too; and these pipes must also be steam-jacketed. Then came the troublesome question of pressure; after that, the greatest of all obstacles, a suitable burner, which would completely, and with the best effect, flame the benzol gas.

I had hoped to have placed before you the results of my experiments to-day. They are, however, incomplete. Many interesting phenomena have cropped up in the course of my researches, which I shall not fail to communicate to you when the work I have undertaken is finished. I expect to show that benzol is little short of acetylene in illuminating value; and it will not surprise anyone if I prove that it depolymerizes—or, shall I say, splits up—into acetylene in the early stage of combustion. Also that the bond which holds the benzol molecule, C_6H_6, together is loosened, and three molecules of acetylene, C_2H_2, naturally fall asunder from it.

No President of any Association could be more fortunate than I am in having friends who have vied with each other to make the office smooth and agreeable; and the hint of my desire to lay something before you respecting the merits of benzol as an enricher brought ready, clever, and reliable helpers with means at command prepared to make practical trials. Very valuable and varied information has accrued from these experiments, coming as it does from experienced practical men. One of them reports exhaustively—taking pressure, temperature, and other affecting circumstances into account; and, after repeated and protracted trials, the details of which cover many sheets of foolscap, he states that the average result of simply passing the gas over cold benzol showed that 8000 to 9000 cubic feet of 17-candle gas were enriched 1 candle for each gallon of benzol consumed. A subsequent trial of a mixture of benzol and toluol (about half and half) was made at the same works, under precisely similar conditions—the mixture being absorbed cold. The results were not so favourable; and it was only found possible to raise the candle power in this way 1·58 candles—showing that, when toluol is used, a slight warming is desirable, as might be expected from its higher boiling-point. The mixture of toluol with benzol did not raise the candle power of the gas in anything like the same proportion as the benzol itself; a gallon of the mixture only fortifying 6000 cubic feet 1·58 candles. The constitution of toluol being C_7H_8, and therefore containing a less percentage of carbon, might account for some of the deficiency; but certainly not all. The reaction in the sphere of combustion—the flame—not yet perfectly understood, is responsible for the rest. At this rate, toluol appears to be more costly for enriching purposes than benzol. Forgive me for mentioning that toluol is methyl benzol—the methyl molecule (CH_3) displacing one of the hydrogen atoms of benzol, completely altering its character, and largely depriving it of its light-giving virtues. I suspect, on burning, this methyl molecule split off first, and, containing three parts of hydrogen to one of carbon, causes the mischief.

These results were confirmed at another large gas-works, where a thorough trial of a mixture of benzol and toluol was made. At the latter works, careful and complete experiments on a considerable scale were undertaken with 90 per cent. benzol. Starting with a gas of 16·50-candle power at a temperature of 59° Fahr., the illuminating power was raised to 21·94 candles, using 1800 cc. per 1000 feet, or a gallon of 90 per cent. benzol enriched 13,800 cubic feet of gas one candle. Mr. Ferguson Bell succeeds in benzolizing about 20,000 cubic feet of gas one candle with a gallon of benzol. The Gaslight and Coke Company in London have for some time employed their production of benzol for enriching, in preference to selling it at current prices. My firm, for chemical purposes, extract the aromatic hydrocarbons from very large quantities of coal gas daily. After this treatment, the gas has no illuminating power, as is seen by the flame in front of me. May I ask you to again compare the same gas after it has been benzolized; showing the remarkable avidity with which the benzol is absorbed. We find that this quality of gas requires more benzol per candle to enrich than better gas to start with.

I have pretty conclusively proved that the difference which has been found in the enriching value of benzol arises from the fact that the trials have been made upon gas of varying constitution, and under different conditions. I have since found, too, that another important element enters into consideration in the matter, and may account for the conflict of opinion that we have among eminent *savants*. It is that, in using a purer benzol, we get an enormously increased illuminating power; so that those gentlemen who have got very high returns must have been using a purer benzol. The difference we found by using benzol of 95 or 96 per cent. purity, as compared with 90 per cent., was prodigious. Mr. Wright truly says: "Illuminating effect is not a fixed quality, unless all conditions are fixed. Change those conditions but slightly, and the luminosity will be greatly modified." The lower the gas is in illuminating power, the more costly it is to improve; and from my experience, it seems to work out in fairly exact ratio to the quality of the gas prior to treatment—*i.e.*, to carburet 10-candle gas might cost 1¾d. each for the first two candles, then 1¼d. each for the next two candles, then 1d., and so on, up to a certain point, dependent on the gas treated, after which the cost increases *pro ratâ* with the candle power. At two of the large works mentioned, this feature was likewise corroborated. A good deal of the benzol appears to be absorbed in some inexplicable manner in the gas without a corresponding return in lighting effect, precisely as is the case (only in a greater degree) with acetylene.

In this week's JOURNAL OF GAS LIGHTING, a table is given showing the illuminating value of acetylene admixed with gas. It confirms my statement. For instance, an admixture of 10 per cent. of acetylene to poor gas, raises it only two candles. Now, as acetylene is said to possess 240-candle power, the addition should have resulted in a gas of 33-candle intensity. I daresay that a mixture of 10 per cent. of acetylene with a rich coal gas would give a more satisfactory result; but there would still be a serious loss of light.

The question of benzolizing gas, in lieu of the numerous other forms of enrichment, is one of considerable moment; and, apart from the points I have raised in favour of its adoption, there is the somewhat important one that the use of benzol for this purpose will take off the market the over-production, which is depressing the value of tar, of which it is an important constituent, and further, that its addition to gas is natural, and objectionless, which cannot be said of other enrichers.

Its application permits of a larger quantity of gas being taken from the coal, as it affords a simple and ready means of keeping up the illuminating power of the gas, and, for purposes of calculations, with average gas it will be pretty safe to assume that one gallon of benzol will enrich 12,000 to 15,000 cubic feet one candle, at a cost of ¾d. to 1d. per candle per 1000 cubic feet.

Discussion.

Mr. HERBERT LEES (Hexham), in opening the discussion, said they had had, to all intents and purposes, a second presidential address from Colonel Sadler. The paper was exhaustive, and explained itself as it went along. In the matter of enrichment with benzol, comparison would naturally be made with other systems of enrichment; and as a commercial experiment, it would he supposed succeed or otherwise according to the results that were obtained. They had proof very clearly before them that benzol was the chief constituent for giving light, in the common coal gas which they supplied, and also that by adding a little more, the lighting was very considerably improved. It would then resolve itself into a question of pounds, shillings, and pence. He had taken a few notes from a paper that was read, he thought, before the North British Association of Gas Managers last year, on enrichment by oil, in which it was stated that the cost of enriching from 16 to 30 candles worked out at less than ¼d. However, he thought that, in making comparisons with oil enrichment, they must take into consideration the quantity of enrichment. The President had shown them that enriching from 10 to 12 candles might cost 1¾d., and to enrich 2 candles cost them less than ¾d. There was a considerable difference then; and it would be interesting to know to what extent the difference was met in the cost. Suppose they enriched from 16 candles to something like 30 candles—that would be an experiment on all-fours with the paper he had referred to—what would be the cost of the benzol enrichment of that gas? As regards the Newcastle district, they were not likely to want to enrich from 16 to 30 candles—they thought that gas of from 18 to 20 candles was very good—but it would be on those lines that they would read the President's paper. There was another point with regard to the use of benzol that might not be generally known. He was told that, in places where it was used in a manner very different from that proposed by the President (that was by heating the benzol to something like 212°, and driving it off as vapour), the result was to do away altogether, during the severe frost, with naphthalene deposits—deposits which were very troublesome, as some of them knew. Benzol would thus be a valuable adjunct to a gas-works during such severe weather as they had recently passed through. There was another point—the cost of the plant was next to nothing. They could fit it up; and if benzol should go to such a figure as to become prohibitive, as oil almost appeared to have done very recently, they would not have expended much money in providing the plant, and they could afford to throw it off. But if benzol should fall in price, they could then resume it.

Mr. J. HALL (West Pelton) asked if the apparatus should be placed before or after the gasholder.

The PRESIDENT said that was very important. He considered that any form of enrichment should be placed on the delivery pipe; and that the enrichment should not go into the gasholder. He said this because the high homogeneity of benzol did cause stratification. He proved this on the previous Thursday. By allowing a comparatively small gasholder to stand a little time, they found a distinct difference between the gas at the top of the holder and that at the bottom.

Mr. W. HARDIE, jun. (Tynemouth), thought that they were all much indebted to the President for coming before them with his very able and instructive paper; and certainly the experiments he had put before them were of very great interest. There was no doubt that in the experiment before them, the small burner in which the Newcastle gas was being burned made it look worse than it should be. It was a No. 4 fishtail burner, which was not a burner that would be recommended by a gas manager for burning gas of Newcastle quality. It was generally conceded that any burner of the flat-flame type under No. 6 was not suitable for this purpose. Judging by appearance, he would say that the quality of the two lights before them should be

something like 12 and 20 candles. He had been most pleased with the paper; and he rose simply for the purpose of asking a question. He noticed that the President brought before them an apparatus for using benzol, which certainly was simplicity itself; and the cost of the apparatus must attract the attention of all of them. This was a very important item with regard to the various processes; but what he wished to ask was whether the enrichment given by the benzol was anything like constant, or whether they had at one time an enrichment of something like 5 or 7 candles for a quantity of gas, and at another time perhaps double that quantity of enrichment for the same quantity of gas. It was an item of consequence whether the thing could be regulated once for all, for a given quantity of gas, or whether it required constant watching to see that the same rate of enrichment took place. There was no doubt that the cost of oil was so much increased since, probably, the latest figures connected with oil gas and water gas had been published, that benzol enrichment would certainly bear a much more favourable relation to those figures than appeared up to the present time.

Mr. HALL asked whether the residue from the benzol was of any relative value after they had taken the illuminating value out of it.

The PRESIDENT said there was no doubt that, with 90 per cent. benzol, they had, as he had pointed out, 25 per cent. of toluol. Toluol did not evaporate so rapidly as benzol; and in benzol of that quality they would have it left. But, as he suggested, the use of a purer benzol (free from toluol, xylol, and cumol) was a very great advantage compared with using what most people in England had been using—viz., 90 per cent. benzol—because there was, he admitted, the difficulty that, as the toluol, &c., accumulated in the benzolizer, more gas must be passed through to take it up. The evaporation would not be so rapid with toluol as with benzol; and he therefore suggested that the best thing to be done was to use practically pure benzol. He admitted that the mischief done to the plant was by the methyl, CH_3; and upon that point he was making some experiments, which he should publish when completed.

Mr. D. TERRACE (Middlesbrough) asked if the President had made any calculation as to the "£ s. d." of the subject—that was to say, whether they could get 500 cubic feet more gas per ton (that was 6d. worth of gas), while spending 1d. or 1½d. on benzol. That was what he would call the *crux* of the whole question. Then, again, as to the passing of the gas over the surface of the benzol, he thought they might run it in in a small stream, and the gas could then take up what it could.

Mr. T. BOWER (West Hartlepool) mentioned that, through the courtesy of the President, he had had the opportunity of making some rather crude experiments himself; for he had not yet gone as deeply into the matter as he intended to do. He might state, at the outset, that he had some little difficulty, which he believed the President had cleared up that day in what he had said about the quality of benzol employed. The benzol which he used was 90 per cent. benzol; and he was quite of opinion that the reason given by the President for getting the high results which had been mentioned, was correct. There was certainly something due to the presence of toluol, &c., which depreciated, as he had explained, the value of the light. In viewing a question like this, Mr. Terrace had asked a very important question. It was all very well for them to get mixed up with enriching schemes, or carburetting schemes, or any other sort of schemes. If they were not to bring any "grist to the mill" by them, what was the use of their giving themselves all the trouble? Perhaps the President would pardon him in saying that he (the President) would bring his scientific knowledge to the subject first, and the "£ s. d." afterwards. But it was more likely that he (Mr. Bower) would bring the "£ s. d." to it first, and the scientific knowledge afterwards. Looking at the matter generally, however, it had often occurred to him, since he had been in the North of England, when they had been speaking of enrichment of gas, whether it was really desirable to go beyond 17 or 18 candle gas. He believed that their consumers would not appreciate 20-candle gas at a little increased cost, or rather that they would not appreciate it to the extent of the increased cost—the increased value of the illuminating power. For this reason, he would be inclined to think that a maximum of 18 candles would be almost as much as would be desirable to give in the Newcastle district. But he was also quite prepared to admit that, if gas could be enriched up to 18 candles, it would be desirable that the best method should be adopted of doing it; and so far as the process they had seen that day was concerned, he was disposed to think there was some advantage in it. Starting with a 16-candle gas, he put in—very similar to the process they had seen that day—90 per cent. benzol, with the result that the very highest result he could get was up to 19·2 candles. Some of his friends, he knew, claimed to obtain higher results. In another instance, he started with 17¼-candle gas, and could only get it up to very little more than 19·3 candles. Then he started again with 19-candle gas, and tried to enrich it as far as he could. But he found again that he could get no more than about ¼ candle. He would not like to put forth these experiments as being anything like definite or reliable, because they were made in a hurry, and not as carefully as he would like to have conducted them. But the conclusion that they pointed to him was that they were not going to get, satisfactorily, an enrichment certainly beyond 20 candles. He took it that the reason for this was, as the President stated, that 15 or 16 candle gas itself contained more than 2 per cent. of benzol. By the additions he had mentioned, they were able to get up to about 3¼ per cent. But he took this 3¼ per cent. as the maximum safe carrier of benzol in the gas, because, as he regarded it, anything above that quantity would simply be lost. As to the volume of gas, they increased that also. One gallon of benzol, which he placed at 1s. a gallon (which, he believed, was about the present market price), increased 7950 cubic feet of 16-candle gas by 1 candle. Taking that 1s. per gallon, the cost would be about 1½d. per 1000 cubic feet. He did not go further in this respect; because he did not think it was desirable, in the Newcastle district, to increase their gas beyond 17 or 18 candles—thinking, as he did, that it would not be appreciated by consumers so much as a less selling price would be. There was one other thing that seemed to him would be important in the introduction of a system like that proposed. If it were once known that it would prevent the deposition of naphthalene—which was the curse of all gas companies in the North of England, at all events—to any extent, it would be a very important factor in its introduction. He would also like to ask whether, in the President's opinion, in enriching gas and putting it, as he suggested, into the delivery main, they could really carry the 2 candles of enrichment to the consumers' burners? That also seemed to him to be an important factor; because it would not benefit them to the same extent if they lost it on the way. He desired to thank the President for the courtesy and kindness he had shown him (Mr. Bower) in allowing him the privilege of looking into the matter; because, but for this facility, he should not have been able to state what he had done. He was sure also the Association were indebted to Colonel Sadler for the trouble he had taken in bringing the matter before them.

Mr. H. TOBEY (Malton) thought they ought to compliment the President on the manner in which he had shown them how to enrich gas. It seemed to him that Mr. Terrace had "hit the nail on the head" in the remark that they might take more gas out of the coal, and might thus use a low-quality coal for the purpose of gas making, and then enrich it by means of benzol, by the very simple apparatus which had been shown to them. It was a process which required no elaborate system of retorts or apparatus of any kind. There was one feature of it which occurred to him. They might use a coal which was not *really* a gas coal at all, in the ordinary sense of the term, but one of very low grade in illuminating power, and bring it up in the manner proposed. They might make and distribute a very poor gas; and it seemed to him that a simple apparatus might be devised, to be added to the meter, which would enrich the gas for lighting, while the low-grade gas could then be used for cooking, heating, and motive power purposes.

The PRESIDENT, in reply to Mr. Terrace, said that the advantage that was likely to accrue to a gas-maker by adopting the suggested form of enrichment, he took it could only be in two ways—the one suggested by Mr. Tobey, and the other which he had mentioned to Mr. Terrace privately. They could either draw off from the coal a good deal more gas than they now did, and add the illuminating power by benzol, or they could make a low-grade gas from a common kind of coal. That, he believed, was advocated by Mr. Lewis Wright in his recent paper before the Society of Chemical Industry. It was a calculation which he thought every practical man there could make. If they took off 8000 cubic feet of gas, giving 15 candles, and then made it into 10,000 cubic feet, how much would the illuminating power be reduced? His opinion was that it would not reduce it very seriously; and they could then add benzol to fortify it to the candle power required. Mr. Bower had asked a practical question. A good deal had been said against benzol, in the direction that it would not carry. Now, he had tried many ways of ascertaining its capacity in this direction; and he had practically confirmed the figures of Dr. Bunte, who said that the gas would carry any distance in Munich—which was a wide, straggling city, and where there was 3 per cent. of benzol in the gas. An ordinary 15 or 16 candle gas very rarely contained 2 per cent. of benzol; he had seldom met with any which contained beyond 1½ per cent. If they added 1 per cent. of benzol to the gas, they increased the illuminating power by 5 candles; so that the capacity for enriching was very great. As regarded its solvent action upon naphthalene, there was no doubt about that; it had a most remarkable action upon naphthalene. He undertook to say they would never find naphthalene in any mains, no matter how far or near they were, if there were anything like 2 per cent. of benzol in the gas.

Mr. TERRACE proposed a vote of thanks to the President for his paper.

Mr. J. WHYTE (Seaham Harbour) seconded the motion.

The PRESIDENT, in acknowledgment, said he thought the questions of profit and philosophy had been very well blended. It had been a very pleasant duty to him to find out how far benzol might go as an enriching agent; and he expected to have, within a few weeks, some interesting information to give with regard to benzol.

Mr. W. HARDIE, jun. (Tynemouth), read the following paper:—

FROST AND GAS SUPPLY.

The subject of this short paper is not one that frequently comes up at our meetings; but as it is one that probably claimed

some attention from most of us about the beginning of last February, a few remarks on some of the inconveniences which the frost causes in certain parts of a gas making and distributing plant may be permitted. The frost then experienced is said to have been the most severe and continuous for about 30 years; certainly, if the damage done to gas and water mains is taken as a guide, it would seem to be without any precedent.

On the works, the pipes supplying water to the various buildings and plant are liable to get frozen up; but the parts most exposed to attack are the water supply to scrubbers, the water supply to hydraulic valves (where these are used), and the freezing in the lutes of gasholders and purifiers. The supply of water to our scrubbers at Tynemouth is taken from an overhead tank, fixed above the boiler-house; and it is carried side by side with a small steam-pipe to the water distributor on the top of the scrubber. The water and steam pipes, where exposed to the air, are wrapped round with straw rope, and encased in a wood box filled with sawdust. This arrangement worked satisfactorily; and the water and ammoniacal liquor supplies to the scrubbers were constant during the frost. The temperature of the gas going into the scrubbers was never under 60° Fahr.; and probably much of the inconvenience in scrubbers and washers might be avoided by laying off a portion of the condensers, so as not to cool the gas excessively.

Our purifiers are fitted with hydraulic valves, and are supplied from tanks at one end of the house, through 3-inch and 4-inch pipes. The water through the leading supply-pipes was kept circulating, by running a small quantity off at the end farthest from the supply-tanks; and the water was kept warm by supplying a little steam into the pipes at a point near the tanks. This arrangement worked very well, though some of the valves and pipes farthest from the leading water-pipe did freeze a little. Regarding the purifier-lutes, it was found sufficient to turn a steam supply into them occasionally. Our arrangement for working the purifiers is as follows: The gas first passes through two purifiers, each 24 feet square; and it is then divided into two streams, and passes through two set of purifiers, each containing four purifiers 20 feet by 15 feet.

We had rather a curious experience with one of these purifiers during the frost. This purifier had been filled with lime that had been prepared two or three days previously, and was not put to work for about 48 hours after being filled, when it was found that the gas would not pass through it. Means were taken to make sure that the valves and pipes were quite clear, after which it was decided that the severe frost acting on the moisture in the lime had caked it into a more or less solid mass. The gas was then forced through it at a high pressure—the difference between the inlet and outlet of the purifier being about 12 inches water pressure—and steam from a ¾-inch pipe was allowed to play upon the inlet-pipe. The heat caused by the steam, and by the chemical action of the impurities of the gas upon the lime, caused it gradually to come to its normal condition; and in about three hours the gas was passing through with a difference in pressure of about 1 inch.

Only one of our gasholders has up to now been fitted with steam-pipes; it having been found sufficient with the others to break the ice in the cups with a spade, when they came down to about 3 feet from uncupping. Temporary steam-pipes were found desirable this winter; and these will certainly now be fixed permanently.

As showing the very extreme nature of the frost, I may mention a case in which a small gasholder in a wrought-iron tank became quite icebound, and stopped the supply of gas. This was remedied by placing coke fires at intervals around it; but the best plan for small gas-works is to have a portable steam-boiler, for which many uses, in addition to keeping the holders right in frosty weather, will be found.

But if a frost causes inconvenience in the manufacturing plant, its effects are much easier to prevent and cure there than in the distributing system. The number of escapes of gas, and of stoppages in consumers' and public lamp services are largely increased at such a time. The number of broken mains in North Shields during the frost was six. These all occurred in 3-inch and 4-inch mains; and the minimum cover of ground over them was 24 inches. Our near neighbours at Newcastle had 54 broken mains; the sizes being as follows: Four 2-inch, forty-five 3-inch, two 4-inch, one 5-inch, and two 10-inch. The cover of ground in these cases varied from about 24 inches to 36 inches. In "King's Treatise on Coal Gas" (Vol. II., p. 362), it is stated that the depth of cover for pipes less than 8 inches in diameter should not be less than 21 inches; and above that size, from 2 feet to 2 ft. 6 in. These are about the depths of cover generally adopted. If, however, our climate so changes that frosts such as we experienced last winter come often, the advisability of laying our mains at a greater depth must be considered; but while they remain so abnormal as at present—coming only about once in a lifetime—the plan of laying mains a depth of 3 ft. to 3 ft. 6 in. does not commend itself to me.

As regards consumers' complaints of bad supply of gas, I find that the number of complaints during February, 1895, owing to the frost, was ten times the number during February, 1894; and the highest number in one day during the frost was fifty times the daily average for the corresponding month of the previous year. Notwithstanding this large increase in complaints, they were in almost every case remedied the same day. The cause of these stoppages appears to be that the moisture in the gas—which may amount to 1 per cent.—is condensed and frozen, and that some hydrocarbons of the benzene and naphthalene series are at the same time deposited. That some of the light-giving hydrocarbons are deposited, is shown by the loss in illuminating power when these deposits occur; and that this is caused only by moisture in the gas, is proved by the fact that no deposit takes place on passing the gas through a freezing mixture of salt and snow, if the gas is first sent through drying-tubes of calcium chloride. The usual method adopted to remove these obstructions is to pour salt and boiling water down the service, and then use the air force-pump to drive it into the main-pipe. With the lamp-services, we generally use a steel wire down the pipes, before employing the force-pump. Occasionally using the force-pump blocks the service so hard that it can only be cleared by lifting the ground; but this is fortunately a rare occurrence. We have also used a "Non-Freezing Composition" for removing the lamp stoppages, which our workmen consider assists them very much.

In this short paper, I have laid before you our own experience and observation; and I hope the few facts mentioned may not be entirely without interest. There are, however, many gentlemen here who must have had similiar experiences; and if, as the result of these, they are able to make some practical suggestions as to the best way to deal with such a state of things, we should be pleased to listen to, and learn from them.

Discussion.

Mr. H. Tobey (Malton) said they were all much obliged to Mr. Hardie for recounting his experiences during the late frost. Most of them, he had no doubt, had had some trouble during that period of vexation and annoyance, from stopped pipes and frozen meters. The author had referred to the arrangement with regard to his scrubbers. Mr. Hardie appeared to have upon his works a steam-boiler which was always going, and from which he could at any time get a supply of steam, to apply where he wished it. But in some works, no steam-boiler was employed—only gas-engines were; and in such cases the difficulties in working a water scrubber were very considerable. After a year or two's experience he had come to the conclusion that he ought to put in one of Fletcher's gas-heated boilers. The pipes from it were taken round the scrubber, or to the top; and he found it very effective. It kept him clear of ice during the past winter. With regard to the freezing of the lutes of the gasholders, it was certainly difficult, in a frost like that of last winter, to keep them clear, though, no doubt, it could be done by steam or by salt and water. The salt and water would, however, require considerable attention. Mr. Hardie had given them some statistics with regard to breakages in pipes; but he had not given them any reason, or explained as to why these mains broke—whether it was from contraction on account of the cold, or otherwise. He (Mr. Tobey) was rather doubtful himself as to how a main, situated so deep, could possibly be fractured by contraction from cold. Putting hot water down a service-pipe, led with him to the blocking up of a main; and for a short time the supply of gas to some houses was entirely stopped.

Mr. E. H. Millard (Durham) said, with reference to Mr. Hardie's proposal to bye-pass part of the condensers, that the object of the condensers was chiefly to get rid of the tar; and he thought it would be a very poor matter to bye-pass the condensers and thus get tar into the scrubbers. It would be much better to maintain the temperature of the gas so that there would be no fear of the water in the scrubbers reaching anything like freezing point. In Durham they were unfortunate in respect of the mains and services being exceedingly shallow; but, by prompt attention to complaints, and the use of a non-freezing compound—which, by the way, the men took out boiling hot—they were able to keep nearly all their services clear by means of a very small quantity of the liquid. He found that with the public lamps, regarding which they had frequent complaints, in every case the stoppage was due to the elbows on the service-pipes at the base of the pillars. He had renewed them, putting in bends, so as to do away with the difficulty.

Mr. T. Bower (West Hartlepool) said this subject was one in which they were all interested. A few years ago, he had two systems for reducing the capacity of the condensers. He had eight tubular condensers; and there was a bye-pass arrangement whereby he could have four on and four off. He used this arrangement for three weeks; and, finding it was not to his satisfaction, he made an arrangement of flaps, fastened to longitudinal spindles along the top and the bottom of the condensers. These were fitted on to a main spindle, and were revolved by a ratchet and wheel at the end. When he wanted to reduce or increase the temperature, all he had to do was, instead of bye-passing part of the condensers, to open or shut the flaps at the top or base either partially or altogether. By closing the flaps, he reduced the quantity of air passing through the internal portions of the condensers; and so he kept up the temperature. To his mind, this was a better arrangement than bye-passing the condensers. He thought it was a matter which should be attended to; because there was no doubt that if they reduced the gas below 40° Fahr. at the condensers, and then had to raise it by passing it through or over mechanical contrivances, such as scrubbers, they were bound to have more or less trouble with naphthalene. It seemed to him that if they watched the scrubbers more carefully, they might possibly be able to avoid

naphthalene. He had very little trouble last winter with the governors, which were in a sheltered position. Hitherto he had not found it necessary to heat the governor-house; but, after his experience of last winter, he should certainly have it heated. One night, the water there was frozen quite solid; and if it had not been for an arrangement of bye-passing, and getting on to another governor, serious results might have followed. As it turned out, they had only a little temporary inconvenience. He had much more trouble with the gasholders than he ever had before. He had no steam; and he had simply to resort, time after time, to the simple breaking of the ice by hand, which was not only troublesome and expensive, but dangerous in several ways—such as piercing the plates of the gasholder, damaging paint, &c. Before another winter, he hoped to have something done to enable him to deal with ice in the gasholders. His difficulty was in deciding which was the best method to adopt. All the tanks in his works were underground; and he would have to consider whether an ordinary steam-pipe led into them would be sufficient. It was very annoying both to gas suppliers and to gas consumers to have constant complaints of stopped gas. Many people did not complain of the stoppage of the gas, but of "the bad quality of the gas;" and Mr. Hardie was quite right when he mentioned that if they had a deposit of naphthalene, they were bound to have a reduction in the illuminating power. Consequently, a less quantity of gas passing to the burners, of a lower illuminating power, doubly aggravated the matter; and consumers, not knowing this, very often blamed them for supplying bad gas when it was not owing to bad gas at all, but to the naphthalene.

Mr. J. Armitage Drake (Halifax) said he recently came across a contrivance, whereby, by taking off the ordinary water cooling-tanks connected with a gas-engine and coupling up with the gas-holder by means of flexible tubing, the difficulty of frost-bound holders was overcome.

Mr. Hardie thanked the members for the reception they had given to his paper. Regarding Mr. Tobey's query, he knew that some people had doubt whether gas-mains, as well as other mains, were broken by frost; and he suggested that the pipes were broken previously, but that the fractures were not discovered until the frost hardened the ground and prevented the gas getting away, as it usually did, through the soil. But he (Mr. Hardie) was inclined to think that the pipes were broken by the frost; and probably the reason was that the ground was so hard that the pipe, upon contraction, could not get vent, as it would do if the ground were more pliable. So it broke. As regarded the matter of the condensers, he did not suggest anything, practically, more than that he thought it was a pity to reduce the gas to a temperature lower than, perhaps, about 60° Fahr. People had suffered by having the scrubbers thrown out of gear for a considerable time, which he could only consider was owing to the gas or the water being supplied to them at too low a temperature.

The President proposed a vote of thanks to Mr. Hardie for his eminently practical paper. One point struck him as being interesting from a chemical and technical point of view—the clause in which the author stated that, when the gas was denuded of moisture, there was no deposition other than that of some of the light hydrocarbons. That should, he thought, give some encouragement to his friend Mr. Bower, who expressed some doubt as to the carrying capacity of benzol. He should have liked to have asked Mr. Hardie whether, if they cooled the gas sufficiently before they passed it to the subsequent plant for the recovery of ammonia and other residuals, they would get any naphthalene after that. It seemed to him that the remedy was in their own hands. If they once lowered the temperature of the gas down to any temperature to which it would ultimately be exposed, they would have no naphthalene in their mains. But the remedy was, of course, benzol.

Mr. Lees seconded the vote of thanks to Mr. Hardie for his paper, which was agreed to.

Vote of Thanks to the President.

Mr. W. J. Warner (South Shields) said that Mr. Terrace proposed a vote of thanks to the President for his paper, which was one of the ablest, if not the ablest, paper they had heard read at the meetings of the Association; but he wished to propose a vote of thanks to him for the manner in which he had conducted the affairs of the Association during his year of office. It was anticipated, when he accepted the position of President, that they would have contributions to their transactions which would be most creditable to them, and which would raise them very much higher as a technical Association; and those anticipations had been fulfilled. Their transactions were not confined to the members of the Association, but were of a world-wide character; and he had no doubt whatever that the President's paper would go the whole circuit of the earth.

Mr. Hall seconded the proposition.

Mr. Lees was sure that they could not thank the President too much for the able manner in which he had conducted the business of the Association during his presidential year. They were hopeful that, now that he had come so actively among them, they would have his presence with them again. He thought they had a claim upon him, because he was conducting some experiments of which he had promised to give them the benefit.

The President, in acknowledgment, said he esteemed it no little distinction that he, belonging, as he did, to their Association since its commencement, but as an associate and not as a member, should have been selected to preside over their deliberations; and he was delighted that they had attached some little value to the communications which he had made to them. He would like to acknowledge there that their indefatigable Secretary made the duties of the President very light indeed.

Election of Office-Bearers.

The following gentlemen were elected office-bearers for the ensuing year:—

President—Mr. H. Lees, of Hexham.
Vice-President—Mr. J. H. Penney, of South Shields.
Auditor—Mr. C. D. Drury, of Sunderland.
Secretary—Mr. W. Hardie, of Newcastle.
Members of Committee—Mr. J. Holliday, of Scarborough; and Mr. J. H. Cox, of Sunderland.

Mr. Lees returned thanks for the honour of being elected President.

Place of Next Meeting.

It was agreed that the next meeting should be held at Hexham. This concluded the business.

The members and their friends afterwards dined in the County Hotel; Colonel Sadler presiding.

London County Council Finance.—Last Tuesday, the London County Council's Money and Finance Bills were presented in the House of Commons, and read the first time. The former is to regulate the expenditure of money by the Council on capital account during the current financial period, and the raising of money to meet such expenditure; and the latter, to consolidate and amend the law relating to the raising and provision of money for expenditure on capital account.

The Pelouze and Audouin Condenser in England.—Messrs. R. and J. Dempster, of Manchester, have just completed the erection of a Pelouze and Audouin condenser at the Blackpool Gas-Works, which are under the supervision of Mr. J. Chew. This appliance, which was described and illustrated in the Journal at the time of its introduction some twenty years ago, is well known on the Continent; but we believe the one at Blackpool is the first of its kind erected in England. It may be remembered that the condenser is constructed on the principle of impingement; the gas passing through perforated iron plates, and striking against the surfaces of opposite plates—the solid constituents being deposited in a receptacle below. The condenser just finished is capable of passing 1½ million cubic feet of gas per 24 hours; and the result of its working will be awaited with interest.

The Work of the United States Patent Office in 1894.—The Commissioner of Patents for the United States (Mr. John S. Seymour) reports that at the Patent Office during the past year there were received 38,987 applications for patents, 1357 applications for designs, 95 applications for reissues, 2296 caveats, 2053 applications for registration of trade marks, and 371 applications for labels. There were 20,803 patents granted, including designs; 64 patents reissued; and 1806 trade marks registered. The number of patents which expired was 12,920; the number which were, by operation of law, forfeited for non-payment of the final fee, was 3812. The total expenditure was $1,100,047. The surplus of receipts over expenditure was $87,392; and the total balance to the credit of the office in the Treasury of the United States now amounts to $4,369,136. In proportion to population, more patents were issued to citizens of Connecticut than to those of any other state; next in order came Massachusetts, the District of Columbia, New Jersey, Montana, Rhode Island, New York, and Colorado. The fewest patents in proportion to the number of inhabitants were issued to citizens of South Carolina, Mississippi, North Carolina, Arkansas, and Georgia—following in that order.

The London County Council and the Water Question.—At the afternoon sitting of the House of Commons yesterday, Mr. J. Stuart moved that the order committing the Chelsea Water Bill be read and discharged, and that the Bill be referred to the Select Committee considering the Lambeth and the Southwark and Vauxhall Transfer Bills. Mr. Boulnois objected, on the ground that the reference to such a Committee was unnecessary, and would be likely to kill the Bill, the object of which was merely to raise £50,000 for the purpose of laying a new main. Mr. Brunner and Mr. H. W. Lawson supported the motion; Mr. Whitmore, Mr. Long, Mr. Kimber, and Mr. Bartley opposing it. Mr. Shaw Lefevre, amid expressions of dissent from the Opposition, said he saw no reason why the Committee should not complete this session both its own special inquiry and the examination of this Bill. Sir John Lubbock said if the motion was passed, it would destroy all prospect of the Bill being carried this year. The House subsequently divided, when there appeared for the motion 163, and against it 129. The motion was therefore carried by a majority of 34. The London County Council meet to-day for the first time after the Easter recess. Among the notices of motion is one by Mr. Holland—"That the Water Committee be instructed to consider and report to the Council without delay as to the constitution and powers of a Water Authority for London."

REGISTER OF PATENTS.

Counter-Current Air-Heaters for Gas-Fired Furnaces.—Leigh, H. H.; a communication from A. Klönne, of Dortmund, Germany. No. 4830; March 7, 1894.

The claim for this invention is for a counter-current air-heater, in which the hot-air flues which are conducted by the side of the air-flues either in a straight line or zig-zag direction, are constructed in such a way that one or two walls of it serve as side walls for one or two air-flues; the latter also being constructed zig-zag shaped, so that the air moves at least in one of the flues which form the whole of the air-flue, opposite to the direction of the hot-air currents.

The patentee remarks that it is of importance to work gas-fired furnaces with as weak a draught as possible in the air-heating chambers, in order that the process of combustion may not be injuriously affected by the inevitable flaws in the party walls of the various flues, which flaws may be due to the porosity of the stone or to the settling and shrinking of the masonry. In order to minimize the draught, in point of strength, as much as possible, it is necessary to give the gas and air flues as large a cross section as may be practicable. This object the present invention attains, dividing the flues both for air and gas into several independent chambers or groups of flues or channels, according to a series of detail drawings accompanying the specification.

Gas and Like Engines.—Farmer, J., of Beckenham, Kent. No. 7294; April 12, 1894.

This invention relates to gas and other internal combustion engines of the compression type, in which a power impulse is given for every revolution of the crank-shaft. The object aimed at is to produce a gas-engine of this type in which the difficulties common to previous "impulse-every-revolution" engines are overcome. One great difficulty in such engines has been found to arise from the liability of the gaseous charge to pre-ignition during compression, or during the introduction of the inflammable charge into the cylinder. This is one of the difficulties said to be overcome by this invention. Another difficulty common to high-speed engines of this class, is due to the insufficient cushioning of the piston, and consequent knocking produced when the engine runs fast. Part of the present invention has for its object to overcome this difficulty by so arranging the parts that all reciprocating pistons are kept in constant compression in one direction—thus securing the continual pressure of the connecting-rod brasses against the crank-pin, or the continual pressure of the eccentric sheave upon the eccentric pulley.

Purification of Anthracene.—Newton, H. E.; communicated from the Farbenfabriken, vormals Friedrich Bayer and Co., of Elberfeld, Germany. No. 7862; April 20, 1894.

The purification of raw anthracene is usually effected by means of hydrocarbons or naphtha, or with the aid of aromatic bases of the aniline or pyridine or quinoline series (see patent No. 5785 of 1887), or by means of liquid sulphur dioxide, as described in patent No. 5539 of 1892. It is claimed, however, that the present patentees have found that the purification of raw or technical anthracene may be effected by means of ketones of the fatty series, especially acetone and the homologues thereof, which are advantageously used, for the sake of cheapness, in the form of so-called "raw acetone" or "acetone oils;" these agents "possessing in a high degree the property of dissolving the associated impurities in crude anthracene, whilst the anthracene itself is almost insoluble therein."

One method of carrying out this new process is to mix 500 parts of raw anthracene (by stirring) with 750 parts of acetone in a closed cylinder, provided with a steam-jacket and stirring apparatus. The mixture is heated to 60° C., and kept at this temperature during about an hour, after which time the mass is allowed to cool. The anthracene is then filtered off, and washed with 375 parts of fresh acetone; the acetone thus used for washing being separated, and made use of in purifying a fresh quantity of anthracene. The first mother liquors are distilled, in order to recover the acetone. The anthracene remaining on the filter is pressed and dried in the usual manner.

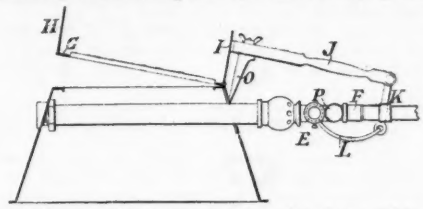
Gas Motor Cars.—Holt, H. P., of Chancery Lane, London. No. 8295; April 26, 1894.

The claims made in respect to this invention connected with gas-driven tramcars are: 1. In order to lessen the oscillation of the car, the inclining of the axle-box guides relatively to the axis of the cylinder, or the axis of the cylinder relatively to the axle-box guides, so that the axle-boxes slide at right angles to the line of the connecting-rod when it is in its position of greatest downward thrust. 2. A particular combination (with the starting lever of the car) of a cam lever, chain, loaded lever, and valve. 3. Combining with the governor of the engine and the gas-valve lever moved by it, a cam so stepped that, when the lever is moved down the step, the gas-valve is opened later in the stroke.

Automatically Regulating Gas Supply to Stoves, &c.—Rice, G., of Kingsthorpe, and Wooding, J., of Northampton. No. 9063; May 8, 1894.

This invention refers mainly to shoemakers' or bookbinders' finishing-stoves, so that when in use the required quantity of gas may pass through the supply-tap, but when not in use the tap is turned nearly off, and only enough gas is allowed through it to give a flame sufficient to withstand ordinary draughts.

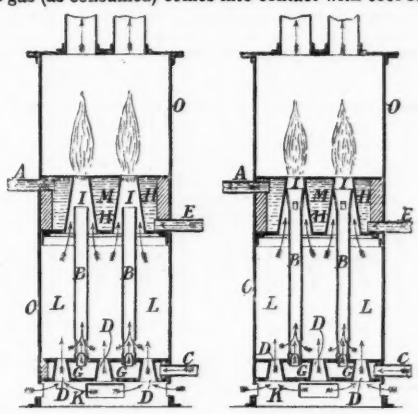
The drawing shows the frame of an ordinary finishing-stove. To the upper part is hinged one end of a metal plate G, made of a corresponding shape to the frame beneath it. It is provided with two end-pieces H I, one of which carries a longitudinal lever J, which connects by a link K with an arm or crank L secured to the thumb-bit or socket M of the supply-tap E. There is a slot formed in the lever, in which the threaded portion of the check-piece O may be adjusted, for regulating the movement of the lever and supply of gas. By placing (say) a tool or other weight on the hinged plate, the effect will be that the plate and lever J will assume a horizontal position, the action of which causes the supply-tap E to be turned on, so that the required amount of gas may pass. When the tool is removed, the plate immediately returns to its normal position, as illustrated, by reason of the



lever being balanced slightly heavier than the plate. This causes the supply-tap to be turned nearly off, and allows only sufficient gas to feed a very small flame. For regulating the supply of gas to the stove, there is inserted in the tap E a small screwed valve P, which can be adjusted according to the amount of gas required.

Bunsen Gas-Burners.—Graf, F., of Aix-la-Chappelle, Germany. No. 9209; May 9, 1894.

Referring to the object in view in arranging this invention, the patentee says: It has hitherto only been possible to use Bunsen burners economically in the open air. In narrow close spaces—such as are not in direct communication with free air—it has only been possible to cause them to burn with a blue non-luminous flame by blowing considerable quantities of atmospheric air through the burner-tube. The only object of thus passing air through the burner-tube has been to keep cool the surfaces on which the combustion takes place, since a Bunsen burner, when burning in a confined space, only continues to do so with a blue flame as long as the surfaces with which the gas comes into contact as it is consumed do not become hot. The result of failing to cool the surfaces is that in a short time the flame becomes yellow, and has its heating value greatly diminished. On the other hand, by cooling the surfaces with air, the temperature and heating power of the blue flame which results are very considerably lowered, to say nothing of the power expended in driving the blower. Then, further, it is difficult to control the supply of air; and it is impossible to attain an equable flame production with unequal action of the bellows and feeble pressure of gas. By this arrangement of Bunsen burner, these disadvantages are avoided, by causing the burner to open within a nozzle the outer part of which is kept cool with water, so that the gas (as consumed) comes into contact with cool surfaces.



Two forms of burner are shown. O is a sheet metal cylinder; B, the burner-tubes; C, the lateral opening by which the gas enters the gas chamber; D, sheet metal nozzles through which the air passes from the lower to the upper chamber; E, the tube by which the cool water enters. A is the exit-tube for the water. G is the gas chamber; and H, the water-cooled conical nozzles. I are the upper extremities of the tubes B. K is the lower chamber; and L the upper chamber. M is the water chamber surrounding the conical nozzles H.

Referring to the left-hand burner shown, the tubes B have lateral openings at their lower part; and through these atmospheric air enters and mingles with the combustible gas. This air enters through lateral openings at the foot of the cylinder O; reaches the upper chamber L through the air-nozzles D; and passes from this chamber partly into the burner-tubes B, and partly into the water-cooled nozzles H. The gas, which enters the gas chamber G at C, rises in the tubes; mingles, as in ordinary Bunsen burners, with air; and the mixture of gas and air passes on to be consumed at the ends of the tubes B at I, in combination with the air which enters the water-cooled nozzles H. Since a current of cool water is constantly passing round the nozzles and is constantly renewed, they cannot become hot; so that the gas, while being consumed, is always in contact with cool surfaces. The supply of air, which is thus not designed in the case of this burner to cool the same, can therefore be so regulated that the combustion can be conducted on such lines as to afford the maximum of heat with the greatest economy of gas. Above the tubes B, there passes (within the water-cooled nozzles H) a mixture of the air, which rises through the nozzles with the mixture of gas and air that ascends in the tubes B. On entering the wider chamber, the two currents expand and intermingle; and consequently the whole mixture of gas and air is cooled in the upper part of the nozzles.

The other form of construction shown differs only inasmuch as the burner-tubes B are widened above and united to the cone H. The air required for the combustion here enters the burner-tubes by holes from the nozzles H, to reach the mixture of gas and air in the burner-tubes.

Gas or Vapour Engines.—Dickinson, W., of Sunderland. No. 9305; May 11, 1894.

This invention has reference to a double-acting gas-engine—that is, one capable of having a cycle of operations adapted to produce two impulses per revolution.

In connection with the motor cylinder, gas and air pumps are adapted to compress these fluids to any required ratio of pressures; and the piston of the motor cylinder is made of a length approximately equal to the stroke *minus* the width of the air-port device described later on.

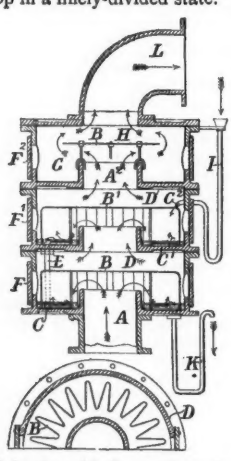
There is arranged a central air-port and terminal exhaust-ports to the motor cylinder; and gas-ports may likewise be arranged in suitable positions towards either end of the motor cylinder; so that, on the piston travelling in one direction, it finally uncovers the central air-port, and a scavenging charge under pressure from the air-pump entering thereat behind the piston drives out the products of combustion through the exhaust-port. On the return of the piston, at a certain point, the exhaust-valve closes; and a portion of the scavenging charge behind the products of combustion is trapped or retained; and into this gas, or a mixture of gas and air, is forced—the whole mixture being then further compressed by the motor piston until ignition takes place to again drive out the piston.

The piston acts as a valve to the central air-port, which delivers its scavenging charge at a pressure alternately in reverse directions to the exhaust at the opposite ends of the cylinder; and the precise timing of the various openings and closings of the exhaust, gas-admission, and other valves will be set to suit the particular requirements of the case.

Drying Lighting Gas.—Buer, J., of Dessau, Germany. No. 9457; May 12, 1894.

This is an invention of "a method of drying lighting gas, in which liquid sulphuric acid is employed as a drying agent; the specific gravity of the acid being not higher than about 1·691, and not lower than about 1·615—that is to say, not so high as to appreciably injure the lighting power of the gas, but high enough to allow of an appreciable reception of water to take place."

Alluding to his proposal, the patentee says: The water-absorbing power of sulphuric acid renders it suitable for many drying purposes, including the drying of gases. However, for drying lighting gas, the use of concentrated sulphuric acid has heretofore been deemed inexpedient, as in the passage of the gas through the acid, the latter withdraws, not only water, but also heavy hydrocarbons, so that a considerable loss of lighting power is experienced in that case. Numerous experiments have shown that it is nevertheless possible to advantageously use sulphuric acid for drying lighting gas, and yet obviate a diminution in the lighting power, if the sulphuric acid does not exceed a certain degree of concentration. This condition has, however, not been recognized in the use, as formerly proposed, of sawdust or other porous materials soaked with sulphuric acid; and it has not therefore been taken into account. On this fact is based the present invention, the characteristic feature of which lies in the employment of sulphuric acid having a certain degree of concentration. Sulphuric acid generally possesses such a property at a specific gravity not exceeding about 1·691. If use be made of an acid of higher specific gravity, the lighting power of the gas will not only be reduced, but a resinous body will be separated in the purifier, which in a short time gives rise to clogging, and consequently to disturbances in the working. In order that the sulphuric acid may also have a drying effect, it should not be below a certain concentration—such concentration as corresponds in general to a specific gravity of about 1·615. The drying is advantageously effected by the current of gas being brought, in as fine a division as possible, and with little loss of pressure, in contact with the sulphuric acid so often that the acid will be properly utilized, and the gas sufficiently dried. Thus the gas may be caused to pass through scrubbers filled with pieces of broken glass or other material capable of resisting the action of sulphuric acid, and by means of which the latter is caused to drop in a finely-divided state.



As shown, the sulphuric acid flows through the apparatus from above; while the gas to be dried passes in the opposite direction. By leaden caps provided in each cell, the gas is compelled to pass in a finely-divided state through a stratum of sulphuric acid; and by putting on more cells, the gas may be washed by sulphuric acid a greater number of times—once in each cell.

The gas passes at A into a leaden cap B, furnished in the lower cell D of the apparatus, and dipping into the nearly-spent sulphuric acid, which flows in from the upper cell D^1 through an overflow-pipe E. In order that the current of gas may pass at not too great a velocity, and in as fine jets as possible, through the sulphuric acid, the leaden cap is made star-shaped, and has its immersed lower edge provided with notches C. After the gas has passed from the cap through the sulphuric acid into the lower cell proper D, it is conducted through the pipe A^1 into the leaden cap B^1, arranged in the cell D^1 above, which receives through an inlet C^2 the sulphuric acid necessary for the operation. The dried gas passes through the pipe A^2 into the upper cell G, wherein a distributing-plate H may be arranged above the pipe, in order to retain any liquid which may have been carried away, and thence leaves the apparatus through the outlet L. The several cells are preferably lined with lead, and connected with each other by flanges. They possess moreover openings fitted with covers F^1 F^2, through which access is gained to their interior. The spent sulphuric acid which has become too dilute by the reception of water, leaves the lowest cell through the outlet K, forming an overflow-pipe, and may be concentrated for further use.

When employing the proper strength of acid, it is possible to remove with 1 kilogramme about 220 grammes of water from the lighting gas. As according to extensive experiments, about 7 grammes of water must be withdrawn in winter from each cubic metre of gas, in order to protect it from freezing, it is possible to dry about 30 cubic metres of gas with 1 kilogramme of sulphuric acid having a specific gravity of about 1·691. As moreover spent acid may be easily concentrated for further use, the cost of drying is insignificant, especially when compared with the advantages gained thereby. It is, however, of the greatest importance for the entire method and the practical working of the same, says the patentee, that with the described employment of liquid sulphuric acid the before-stated limits of concentration are easily controllable at any time during the operation by measuring the specific gravity, which is not feasible when using sulphuric acid mixed with sawdust or the like. If in the present method it is found, by taking a sample, that the sulphuric acid runs off considerably above the before-stated minimum concentration, the admission of the acid may simply be interrupted or retarded. A further important improvement in the method "consists in that the operation is continuous, whereas the drying of the gas by porous materials soaked with sulphuric acid necessitates periodical interruptions, after the manner of the operation of purifiers."

Removing Deposits from Gas-Retorts.—Good, R., of Carshalton, and Spencer, S., of Great St. Thomas Apostle, London. No. 10,110; May 24, 1894.

The specification of this patent states: "The deposit of carbon found inside the retorts is caused to scale off, by being suddenly cooled on one side whilst heated on the other side by the retort. For this purpose, jets of water are caused to play upon the carbon on the insides of the heated retorts. The sprayer should be perforated with small holes, and a regulating-cock should be provided. No more water should be used than is required to cool the carbon, and cause it to scale off the inside of the retort. The operation is best performed whilst the carbon deposit within the retort is at a dull red heat."

Gas-Engines.—Holt, H. P., of Chancery Lane, London. No. 10,113; May 24, 1894.

This invention relates to means (1) of reversing gas motor engines, (2) of economizing lubricant in working them, and (3) of preventing the disagreeable odour which characterizes the discharged products of combustion when the cylinder is supplied with excess of lubricant.

The reversal of a gas motor engine is effected in the following manner: The ignition of the combustible charge in the cylinder being arranged to take place a little before the crank reaches its back centre, advantage is taken of this to effect the reversal by providing stops for driving the eccentrics or cams which work the valves, or the shaft which carries them, so that they shall always be in the right position relatively to the crank, whether it revolves in the one direction or the other. The speed of the engine is reduced until the fly-wheel has not sufficient momentum to carry the crank over its back-centre; and then the effect of ignition before the crank reaches that centre is to propel the piston in the reverse direction. The eccentrics or cams which were driven by one set of stops are now driven by the other set; being thus turned to suit the reversed movement of the engine. In cases where there is a reservoir of compressed gas (as in gas motor cars), provision is made for starting the main engine in either direction by means of a small engine—employing as working fluid for this engine a portion of the compressed gas, and collecting the exhaust gas from the engine in a suitable receptacle, whence it is drawn to charge the main engine.

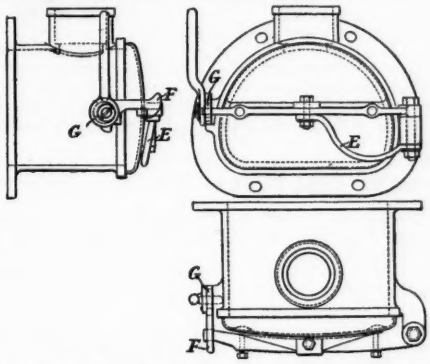
For the purpose of economizing lubricant, and preventing the odour from the discharged products of combustion when the cylinder is supplied with an excess of lubricant, there is connected to the lever or rod which, under control of the governor, opens the gas-supply valve, a lubricating apparatus that may be a wire, which, whenever the gas-valve is opened, dips into an oil receptacle, and transfers a portion of the oil to the lubricator of the cylinder. Or, by the opening of the gas-valve, a pawl may be moved, so as to act on a ratchet-wheel on the spindle of an oil-cock, which, after a certain number of charges of gas, admits a certain quantity of lubricant to the cylinder.

Fastenings for Retort-Lids.—Mitchell, J., of East Greenwich, and Tysoe, J., of Blackheath. No. 20,061; Oct. 20, 1894.

This fastening device for the doors of gas-retorts includes the hanging or supporting of the door itself.

The mouthpiece is of the usual construction, with a hinge socket at one side, and a latch or boss at the other. The door has a faced end to the mouthpiece, and an approximately sharp edge upon the door. The door is carried upon a cross-bar, pivoted upon a bolt passing through the hinge socket of the mouthpiece; the bar extending at the other end beyond the door underneath the pivot catch, to be presently described. The bar is connected to the door by a central bolt passing through a lug upon the door; and preferably two set-screws are provided near the edges of the door and screwing into the bar, by which it can be turned upon the bolt, and its edges or working face thereby accurately adjusted to the face of the mouthpiece. There is also a curved supplementary supporting-arm E, pivoted upon the hinge bolt, and connected

to the door or bar or both, as (for example) by means of the bolt represented in the drawings.



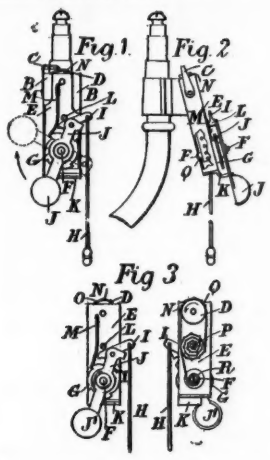
The fastening device consists of a latch F pivoted upon the eccentric boss G of the handle by which it is worked; the boss itself being carried upon a pivot-pin secured upon the side of the mouthpiece or boss. To release the door, the handle, which, when the door is closed, normally stands in an approximately vertical position above the pivot-pin, is drawn forwards into a horizontal position or into a vertical position below the pivot-pin. This movement has the effect, by reason of the eccentric boss G upon the handle, of bringing the latch F (the back end of which has a large opening to fit upon the boss) forwards, so that the door can be opened to a slight extent, and the gases from the retort lighted. When it is required to open the door entirely, the latch can be struck up from the end of the bar, when the door is released, and can be pulled completely open.

There is a stop or projection on the mouthpiece for acting upon the shoulders of the latch—one shoulder for preventing the latch from falling too low when the door is open, and the other for preventing the latch from moving too far upwards when it is struck up for the opening of the door. The outer end of the latch is so shaped that, when the door is pushed to, the end of the bar will cause the latch to rise, and allow the bar to pass beneath it and be engaged by the latch when it falls again, which it mayconveniently do under its own weig ht.

Lighting Devices.—Pendleton, B. H., of Evanston, Illinois, U.S.A. No. 25,331; Dec. 31, 1894.

This invention, relating to lighting devices, is more particularly intended for gas lighting; but, by a slight modification, it may be readily adapted for lighting ordinary oil-lamps, gas-fires, &c.

Fig. 1 is a front elevation, attached to a gas-burner. Fig. 2 is a side elevation. Fig. 3 is a front elevation of the front portion of the case, and a view of the opposite side, showing the inside arrangement of igniting tape and other operative parts.

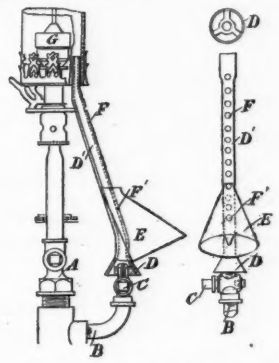


The main portion of the case is rectangular in form, and open at both ends and in front, with the exception of two projections B and B¹ near the top end. A "scratcher" C is attached, as shown; and its top portion is bent over and down—the point coming in close proximity to a roller D, mounted on a pin near the top inside face of the front part E of the case, when the parts are as in figs. 1 and 2. At F is a winding shaft, which passes through the front plate E of the case, and is held in position by the ratchet-wheel G, firmly secured to the shaft, which is free to revolve one-fourth of a revolution at a time, by pulling downward the cord H, the upper end of which is attached to the outer end of the pawl I. This is pivoted to a lever J, and engages the teeth of the ratchet-wheel G. The lever is loosely mounted on the shaft F between the rachet-wheel G and a washer at the outer end of the shaft; there being an outward projection K of the lower end of the case plate, to serve as a stop against pulling the lever J around any farther in one direction than is shown by the dotted lines. There is another stop L, to prevent the weight J from carrying the lever farther around than the position shown in the full lines. There is a spring pawl M, with its free end turned outward to engage with the teeth of the ratchet-wheel G, and serve as a stop to prevent any backward movement thereof. The pawl I is strongly pivoted to the end of the lever J, by a portion of the end of the lever being bent upon itself, so as to form a lug. Thus the pawl-pin is supported at both sides of the pawl, and may therefore be comparatively small. The pawl operates, without the aid of a spring, through the weight of the attached cord and its knob; there being a projection at I of the pawl, which serves to prevent it moving far from the operative position backward.

The tape N, for holding the igniting-points O, is first placed in the coiled form around a pin P, after which its outer end is brought up around the roller D, thence down to the winding-shaft F, where the end is inserted in the slot R, and the shaft given a revolution to fasten the end of the tape therein. It is obvious that, since the shaft F is turned but one-fourth of a revolution at each pull of the cord, this action would cause a less length of tape to be wound on the shaft at each fourth of a revolution at the beginning than when the tape has been almost all wound upon the shaft; so that the igniting-points are placed gradually wider apart from the first to be used of the series to the last. This arrangement of the points ensures that but one at a time will be ignited by each pull of the cord. The inside end of F is prolonged sufficiently to enter a hole Q in the rear through the main part of the case, when the portion shown in fig. 3 is slid up into the main case under the projections B and B¹; the projections pressing upon the front plate E, which serves as a spring to first bend outward, and finally to force the end of the shaft into the hole Q, and thus form a catch to hold the two parts of the case in their proper relative positions. The stud pin upon which the roller D is mounted to revolve is of a length sufficient to cause its free end to press against the inside of the back of the casing, and hold the front plate E close against the projections B B¹. By successively pulling the cord H downward, all the igniting-points O may be fired as they pass under the scratcher C.

Igniting Apparatus for Gas-Lamps.—Gröbbels, P., of Weimar, Germany. No. 660; June 10, 1895.

The object of this invention is to provide for the lighting of a closed-up gas-lamp by means of a mixture of gas and air burning continuously in the interior of an ignition-tube.



The apparatus comprises a pipe B, which branches off on one side from the gas-supply pipe, below the main lamp-cock A, and carries the igniting-cock C, which is provided with only a small gas-passage. The pipe B also carries an open and downwardly expanding funnel D, arranged around its outlet aperture. The stream of gas that escapes through the cock when opened, draws air into this funnel, so as to produce a mixture adapted to burn with a non-luminous flame. The igniting-tube D is provided with a series of small holes F F¹, commencing a little above the funnel, and continuing almost as far as its upper open end, which is situated just below the gas outlet of the burner G. The lower holes of the igniting-tube are surrounded by a funnel E arranged on one side, the object of which is to prevent the lighting-jet becoming extinguished in windy weather. The upper part of E extends through the bottom of the lamp, so as to prevent the bottom plate from being cracked by flames or hot gases escaping laterally from the igniting-tube.

In lighting a lamp, the lamplighter first opens the cock C, and introduces his igniting jet or lamp from below into the funnel E. The gas, in passing through the cock, draws air through the funnel D, which becomes intimately mixed with the gas. A portion of the mixture thus produced passes out through the lower holes F¹ of the igniting-tube D¹, and becomes ignited. The flame thus generated strikes into the mixture of gas and air in the interior of the igniting-tube, and causes the explosion of the mixture, thereby forcing the flame through the holes F, which thus serve to weaken the force of the explosive ignition of the gaseous mixture inside the igniting-tube. A flame of considerable length still remains, however, and passes out through the upper opening of the igniting-tube. The upward ignition inside the igniting-tube, as just described, takes place almost instantaneously. The lamplighter now opens the main lamp-cock A, to allow gas to issue from the burner G; and, this being at once ignited by the flame proceeding from the tube, all that remains to be done is to shut the igniting-cock C.

Manufacture of Incandescent Gas-Burners.—Arendt, M., of Berlin. No. 811; Jan. 12, 1895.

This invention relates to the mode of manufacturing mantles for incandescence gas-burners—not to the materials employed. The mantle of fibrous network is first carbonized under exclusion of the atmosphere, while placed upon a mould. In this way, its flexibility is retained, while its absorbent properties are said to be increased. The carbonized mantle is then saturated with a metallic salt solution; and, after drying, it is subjected to an oxydizing flame.

Gas-Engines.—Marks, G. C.; communicated from F. Hirsch, of Steinway, N.Y., U.S.A. No. 946; Jan. 15, 1895.

This invention relates specially to marine gas-engines, and others where economy of space and concentration of power is desirable.

In patents Nos. 13,333 and 24,089 of 1894, drawings are given of

opposed power cylinders and pistons connected indirectly with a common crank-shaft; the firing of a single central charge by a single ignitor driving the pistons apart. The object of the present invention is to apply the same principle to opposed power cylinders, in which the pistons, under the force of explosion, approach each other—in other words, to apply the expansive force of the gases at the outer ends of the cylinders, instead of at the inner ends as in the earlier arrangement. In this way, it is possible to retain all the advantages attained in the prior construction—such as the perfect balancing of the parts, avoidance of jar, strain, &c.—and at the same time simplify the construction as a whole.

An important feature of the invention consists in utilizing the passage leading from the central firing chamber to the inlet-ports at the outer ends of the power cylinders as compression chambers, whereby, although the force of the explosion from the single charge of gas spreads instantly to the opposite ends of the motor, the gases act upon the pistons mainly by expansion, and the usual jar and concussion arising from the explosion of the gases are avoided. Another feature is that of dispensing with the intermediate cam-shaft and gearing for operating the exhaust-valve, &c., since the patentee now arranges the exhaust cam, governor, &c., directly upon the central power or crank shaft.

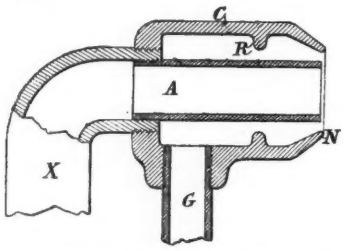
The engine can thus be made so low and compact in form, when compared with others of a given power, that, if used as a marine engine, it can be conveniently placed below the water-line of the vessel, and a natural automatic circulation of cooling liquid through its water-jacket can be maintained, so as to dispense with the use of pumps or other means for effecting a forced circulation through the water-jacket.

Lighting and Extinguishing Incandescent Gas-Lamps.—Thompson, W. P.; communicated from J. Bilfinger, of Stuttgart, Germany. No. 1012; Jan. 15, 1895.

This invention relates to a device for lighting and extinguishing from a distance incandescent gas-lamps having pilot lights; ain feature of such device being that the gas-supply tap is opened or closed by means of two electro-magnet devices in circuit, and capable of being closed from any convenient spot. One of two pivoted iron plates is in each case attracted by the corresponding magnet of the magnet devices, whereby the plug of the tap is turned either to the left or to the right, and the gas supply either opened or cut off.

Air-Blast Gas-Burners.—Fletcher, T., of Warrington, and Russell, W., of Pendleton. No. 1857; Jan. 26, 1895.

This invention relates to air-blast gas-burners employed in furnaces, forges, and the like, and for general laboratory and shop use, with high or low pressure blast.



The burner consists of a central air-tube A, connected at X to any suitable source of air supply under pressure—such as a bellows, fan, or blower—and an annular chamber C surrounding the air-tube, and in communication with a supply of gas. In this chamber, there is an internal ring or annular projection R concentric with the air-tube; and at the open end, the chamber, terminates with a choking nozzle N. The ring and nozzle ensure an equal distribution of the gas around the air-jet; and the burner thus constructed produces a high-temperature flame well diffused, with no cutting action at any points such as occurs with the ordinary form of blow-pipe, and which may be worked with a low pressure of air. Such a flame is particularly adapted for use with gas forges, furnaces for crucibles and muffles, and for annealing, hardening, and tempering chambers. The gas chamber may be connected with the gas supply through a nozzle such as G. The ring R in the gas chamber is of importance, as its presence enables the burner to be made much shorter than it otherwise could be made, and thus minimizes risk of injury.

Water-Meter.—Biermann, J., of Cologne. No. 1876; Jan. 26, 1895.

This invention relates to a water-meter having two turbines mounted on the spindle that actuates the registering mechanism; such turbines being constructed with symmetrically arranged channels, extending partly parallel to the axis and partly obliquely round it, so as to offer the entering water a constant surface. It surrounds the entire body uniformly, has a constant angle, and preserves the axis from lateral pressure. A free space is provided between the turbines for preventing the eddying water from imparting motion to them and the registering mechanism after the discharge-cock has been closed.

Starting Gas-Engines.—Niemczik, A., of Leipsic-Eutritzsch, Germany. No. 1922; Jan. 28, 1895.

In order to start a gas-engine according to this invention, there is arranged a reservoir for compressed air; the compression being effected either by the engine itself while in motion or by a hand-pump. The air reservoir is connected with a lift-valve in the valve-casing; while the gas-pipe is connected with another lift-valve. From the two valves, passages lead through the main cock, or its passages, to a channel which conducts to the compression chamber. This latter is provided with an ignition-pipe, the heating of which can be effected in any desirable manner. In order to set the motor in motion, the main cock is opened after the crank has been brought to its dead-point position. Compressed air and gas then rush into the compression chamber, and, after thorough mixture and collection, ignite at the ignition-pipe. An explosion then follows, which throws the crank forwards, and sets the engine in motion, so that a regular movement can begin. The compressed-air reservoir is so large that, should the first feeding with compressed air and gas under pressure not suffice, in order to effect the compression of the charge, the main cock may be repeatedly opened. If several successive openings of the cock are to be provided for at the commencement, the cock can be worked by the engine itself.

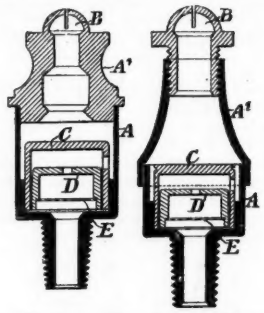
Incandescent Gas-Light Burners.—Busse, M., of Berlin. No. 2679; Feb. 7, 1895.

In gas-burners used with mantles which become incandescent in use, it is found (says the patentee) that the efficiency of the apparatus depends to a large extent upon the sufficient admission of oxygen in the air supplied to the burner. It is the object of this invention "to provide means for the certain and regular admission of air to the burner."

The burner cylinder has its air supply admitted through openings of various sorts formed in the wall of the cylinder at or below the base of the mantle. These openings may be a single ring of holes, or the lower part of the cylinder may be slotted, in which case the openings extend from below the base of the mantle to the bottom of the cylinder. The inventor says he has also found it advantageous to form in the upper part of the cylinder a bulbous enlargement.

Self-Regulating Gas-Burners.—Sugg, W., of Westminster. No. 2992; Feb. 11, 1895.

This invention relates to burners in which a steatite float governor is enclosed in a metal case, which also carries the jet. The objects of the invention are: "To improve the construction of these burners, whereby certain disadvantages of the present construction are obviated; also to simplify the construction, and to reduce the cost of production." Hitherto, says the patentee, the steatite float has been placed directly into the metal case, which, when it becomes hot under the influence of the burning gas, expands, leaving more or less space between it and the float, which does not expand—at any rate, not in the same ratio; and thus the gas can pass to the jet round the edge of the float, and



the governor is not effective. Two forms of burner are shown. A represents the metal case; and A^1, a steatite cover, which is formed in one with the jet B, and is made to fit into the part A, which contains the governor. The part A is formed with a threaded stem, and is of two diameters internally. In the smaller diameter is fixed (by red lead at the bottom edge) the steatite cap, or small gasholder or cylinder C, having preferably, at one side, an elongated opening into the space between the cap C and the larger diameter of the case. A similar effect is produced by making the case of the same diameter internally, and the cap of two diameters externally. Inside the cap C is placed the steatite float governor D, of the usual construction, having an opening of the proper size in the top. E is a disc of gauze, which serves to break up the flow of gas, and prevent noise.

In one modification, the part A^1 is made of metal, and carries at its upper end the jet B. In this case, the part A^1 fits tightly on to the part A.

APPLICATIONS FOR LETTERS PATENT.

7160.—Westwood, W. H., Wright, E. T., and Westwood, W. W., "Manufacture of enriched water gas." April 8.

7227.—Walker, S. S., "Valves for automatically controlling and reducing gases, air, steam, and other fluids from a higher to a lower pressure." April 9.

7281.—Elworthy, H. S., and Henderson, P. D., "Separation of carbonic acid gas from the products of combustion or other mixed and less soluble gases." April 9.

7333.—Stevens, G., "Device for ascertaining the maximum and minimum pressure of water, gas, and air." April 10.

7358.—Fiddes, W., and Cowan, W. & B., Ltd., "Gas-meters." April 10.

7446.—Allison, C. A., "Overhead recuperative or regenerative gas-lamps." A communication from C. Assi and L. Genès. April 11.

7481.—Mackenzie, J. W., "Gas apparatus for obtaining light and heat." A communication from F. de Mare. April 11.

7533.—Sutherland, A. G., Stidder, J. G., and Everett, J. F., "Prepayment gas-meters." April 13.

7540.—Prince, F. O'C., "Incandescent lighting." April 13.

7602.—Braunshausen, V., "Purifying river water." April 16.

7613.—Bennett, R. G., "Incandescent gas-burners." April 16.

7643.—Laval, C. G. P. de, "Manufacture of pipes." April 16.

7660.—Lake, H. H., "Coin-freed apparatus applicable to gas-meters." A communication from L. Haas. April 16.

7709.—Feeny, V. I., "Independent gas-burner regulators." A communication from the Faultless Gas-Saver Company. April 17.

7714.—Crookes, W., "Incandescent mantles." April 17.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The "Workman-Director" Question.

SIR,—I have carefully read your leader on my letter, Mr. Livesey's letter, and your article on "Evidence of the Control of Industries by Workmen-Shareholders;" and I desire, in taking leave of this controversy, to state—

(1) That the cases referred to by Mr. Livesey, and quoted in your article, have nothing to do with, and do not touch, the question of workmen-directors as raised by him in the dropped clauses. There is nothing in common between a co-operative society's committeeman, or a working partner in a private enterprise, and a workman-director in a statutory company, which is a *quasi*-department of the State, working under the supervision of the Board of Trade, such as are the Metropolitan Gas Companies and railway companies. Even in the cases you quote, the workman appears to act in only a consultative, and not an initiative capacity.

(2) With regard to my speech in 1890, if you had quoted it in full, it would have been seen that it had nothing whatever to do with profit-sharing or management-sharing by the Company's workmen. It suggested a method of acquiring longer terms of notice under agreement, to be secured by a retaining fee in the shape of a bonus to the men who accepted the longer terms of agreement.

(3) With regard to originating constitutional changes in statutory gas companies' management, it is not for the directors of such companies to try to vary the terms of a parliamentary bargain, but to carry them out both in the spirit and to the letter.

I shall not seek to intrude further upon your courteously awarded space, as it is an error in tactics to carry on war in a hostile country against a defeated adversary.

WM. THOS. MAKINS.

1, *Lowther Gardens, Prince's Gate, S.W.,*
April 26, 1895.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, April 24.

(*Before Justices* WRIGHT *and* KENNEDY.)

Southwark and Vauxhall Water Company v. Evershed—Another Question as to Water Supply Regulations.

In this case—the parties being the same as in that reported last week (p. 853), and in which judgment was reserved by Justices Cave and Lawrance—the plaintiff Company appealed from the decision of Mr. Denman, sitting at the South-Western Police Court, on an important question arising out of the regulations made by the Board of Trade under the Metropolis Water Act, 1871, and a section of the Company's Private Act of 1884. The facts of the case were as follows: On Nov. 23, 1894, the respondent was summoned to answer a complaint laid by the Company, that he had neglected to comply with the regulations made by the Board of Trade in respect of No. 9, Orchard Street, Wandsworth. Regulation No. 12 provided that every communication-pipe for the conveyance of water to be supplied by the Company into any premises shall have, at or near its point of entrance into such premises—and if desired by the consumer within such premises—a sound and suitable stop-valve of the screw-down kind. By regulation No. 5, it was provided that every house supplied with water should have a separate communication-pipe; but, so far as was consistent with the Special Act of the Company, and where one person owned a group of houses and paid the water-rate for them, he might have one pipe for such group. The Act of 1884, however, provided that the Company were not bound to supply more than one dwelling-house or other building by means of one communication-pipe. No. 9, Orchard Street did not have a separate communication-pipe; and accordingly the Company served upon the respondent notice to put in a communication-pipe and stop-valve. But the respondent contended that he came within the proviso of regulation No. 12. At the Police Court, the Magistrate held that one communication-pipe and stop-valve were sufficient for the whole block of houses owned by the respondent in Orchard Street, and dismissed the summons. From this decision, the Company appealed.

Mr. M'CALL, Q.C., and Mr. HORTON appeared for the appellant Company; Mr. FOOTE, for the respondent.

Justice WRIGHT, in giving judgment, said that, under the Metropolis Water Act, 1871, the Company had power, with a view to starting a constant supply in the district, to serve notice on the owner or occupier of any premises, requiring him to supply the premises with the "prescribed fittings." The prescribed fittings appeared to be those prescribed by the Board of Trade. Then came the Board of Trade regulations, which did not (in terms) define "prescribed fittings" as including a communication-pipe, though no doubt some portion of the communication-pipe was prescribed by the regulations. However, nothing turned upon this. By regulation No. 5, it was provided that every house supplied with water should have its own separate communication-pipe; and if it had stopped there, a notice to supply the prescribed fittings would have been a good notice to provide a separate communication-pipe to each house. But the regulation did not stop there; it went on to say: Provided, so far as was consistent with the Special Act of the Company in the case of a group of houses where the water-rate was paid by one owner, he might have one communication-pipe for such group. That being so, a simple notice to supply the prescribed fittings did not give the owner of the block of houses any sufficient intimation for the purposes of a criminal prosecution under section 31; and a person was not liable to prosecution until, at any rate, he had had specific notice of this section. Even if notice had been given in the present case to the owner, a criminal offence had not been made out, because there was no inconsistency between regulation No. 5 and the enactment in the Special Act of 1884. That Act provided that the Company were not bound to supply water unless there was a separate pipe. This was not inconsistent with the proviso in regulation No. 5 that the owner might put in a common communication-pipe.

Justice KENNEDY concurred; and the appeal was dismissed, with costs.

PENZANCE COUNTY COURT.—Wednesday, April 24.

(*Before His Honour Judge* GRANGER.)

Interpleader Action in Respect of the St. Ives (Cornwall) Gas-Works.

To-day an interpleader action, arising out of the affairs of the St. Ives Gas Company, came on for hearing. The claimants were Neville Day and Charles Robert Wade Gery, Solicitors, of St. Ives (Hunts); and the action was to recover possession of certain goods and chattels seized by the Sheriff of Cornwall at the instance of Messrs. Batten, Carne, and Carne, Limited, bankers, the execution creditors of the St. Ives (Cornwall) Gas Company. The "goods" in question were gasholders, mains, gas-pipes, hydraulic main, scrubber, condenser, brackets, and lanterns, which the claimants said were part of, and attached to, the freehold of the premises.

The claimants had a 999 years' lease of the St. Ives Gas-Works. On March 23, 1890, they undertook to sell the works for £3500 to Mr. Pope, a company promoter; the agreement providing that the deposit of £400 should be forfeited if the purchase was not effected. Before completing the purchase, Mr. Pope promoted the St. Ives (Cornwall) Gas and Coke Company, Limited, and handed over the property to them with the consent of the claimants, who agreed to an extension of time for the payment. After the Company had run a precarious existence of four months, a bailiff was put in possession of the works under a judgment obtained by Messrs. Batten, Carne, and Carne. Mr. Wade Gery gave notice to the Under-Sheriff that he had a claim for rent, and was the owner of the property. The sale was withdrawn; but it was subsequently agreed that the works should be sold, and the money remain in the hands of the Under-Sheriff until the Court had decided to whom it belonged.

Mr. WADE GERY contended that, upon the facts above set forth, he and Mr. Day were practically the freeholders; that the plant mentioned could not be removed without injury to the freehold; and that it was therefore the property of the claimants, and not of the Company.

Mr. E. BOARSE, who represented the execution creditors, argued that a large portion of the plant was removable without injury to the freehold.

Mr. *A. Brown*, formerly Manager of the works, was called, and gave evidence as to the character of the plant in question. He said the two holders could be taken away without disturbing the soil and without losing their essential character or value. Taking the whole as worth £100, these would be worth £5. Some of the mains at the works were above ground; and these could be removed without disturbing the soil, as could also part of the service-pipes at the works, and those attached to the lamp-columns and brackets. The hydraulic main, station meter, scrubber, and condenser could also be removed, as they rested on brick pillars; and the same statement applied to the purifiers, which rested on wooden girders placed across the tar-well. The governor could not be taken away without injuring the freehold. There were 48 lamp-columns, 79 brackets, and 76 lanterns. Seven of the columns were put up by the Gas Company during the time of his management.

His HONOUR remarked that he did not see how the lamp-columns could be claimed as part of the freehold.

Mr. WADE GERY said he admitted that they could not claim the mains under the streets, because they could not break up the streets without the consent of the Corporation.

In cross-examination, witness said he based his estimates on the assumption that the value of the goods claimed by Mr. Gery was £100, and did not represent exactly the market value. If any of these things had been taken away and were not replaced, the place would no longer be a gas-works.

In reply to His HONOUR, witness said he should not like to give £5 for the gasholders as old iron.

Mr. *T. Cock* said he levied under the suit of Messrs. Batten, Carne, and Carne; and he received a letter from Mr. Wade Gery claiming a quarter's rent and a policy of insurance. The first execution creditors admitted the claim for rent; and witness allowed for it in his levy. When he saw Mr. Wade Gery at St. Ives, he told him of it; but he said nothing at that time about withdrawing his claim for rent, and substituting the present claim.

The legal questions were argued at some length. In the result,

His HONOUR said he did not think he could fix the value of the plant as a breaking-up value; and he held that the things referred to could not be removed without injury to the other portions of the plant, excepting some of the lamps and fittings of them. The justice of the case would be met by his fixing the amount the plaintiffs were entitled to recover at £40 out of the £70. For the purposes of the hearing fee, he should fix the value of the goods altogether at £100; and he ordered the execution creditors to pay the claimants' costs.

The Outstanding Dispute between the Liverpool Corporation and the Gas Company.

At the Liverpool City Sessions last week, Mr. Collingwood Hope mentioned that at a previous session he had made an application to the Recorder in the matter of a dispute between the Corporation and the Gas Company with respect to the fixing of meters for testing the gas supplied by the Company. He now asked to be allowed to withdraw the application; the matter having been settled between the parties. The permission was granted.

MISCELLANEOUS NEWS.

PARIS GAS COMPANY.

The Report and Accounts for the Year 1894.

The following is an abstract translation of the report of the Directors of the Paris Gas Company for the past year, with the accounts for this period in our usual condensed form.

The quantity of gas sent out for consumption in Paris and the 59 neighbouring communes served by the Company was 300,823,710 cubic metres, or about 10,619,077,000 cubic feet; being 2,673,140 cubic metres, or about 94,362,000 cubic feet, less than in 1893. This is only half the decrease recorded in that year; and the Directors regard it as an indication that the consumption of gas will very soon resume its upward movement. There are several reasons for this. In the first place, they have doubled their efforts to extend the use of gas cooking and heating appliances in large public and private establishments, kitchens, and workshops. Then gas-engines have caused a notable increase in consumption; while the arrangement entered into with the Municipality, in August last, by which occupants of apartments of less than 500 frs. annual rental are relieved of all supplementary expenses in connection with the gas service, has brought additional business with this class of consumers. Gas-burners of improved types are being adopted by people who had introduced the electric light; the result being a return to the Company of customers who had severed their connection with it. The employment of incandescent gas-lights in place of ordinary burners is, no doubt, one of the causes of the difference of 2,673,140 cubic metres in the consumption of gas in 1893 and 1894; but it has, at the same time, enabled the consumers to effect economies. However, there are signs of improvement. January last witnessed an increase in the quantity of gas consumed; and though the exceptionally severe weather in February checked the advance, by stopping a large number of meters, progress was subsequently renewed, and the Directors look forward to satisfactory results from the present year's working. The day consumption of gas has not ceased to augment, especially between the hours of seven and nine and eleven and one in the morning—in other words, at meal-times. In this fact is to be seen the effect of the adoption of cooking-stoves, which are lent gratuitously to all the Company's customers. The use of gas for culinary purposes has thus been popularized in the smaller households, where it was formerly practically unknown. The output of day gas last year reached 87,427,180 cubic metres, or about 3,086,180,000 cubic feet; being at the rate of 29·06 per cent. of the total consumption, as compared with 28·71 per cent. in 1893, and 27·35 per cent. in 1892. The receipts from the sale of gas amounted last year to 77,098,549 frs., of which 70,227,937 frs. came from the city, and 6,870,612 frs. from the surrounding districts. In 1893, the total receipts amounted to 78,009,633 frs. There was consequently a falling off last year to the extent of 911,084 frs. (£36,443). The number of consumers on Dec. 31 last was, however, greater by 21,334 than on the corresponding day in 1893; the figures being 281,217, as compared with 259,883. Of the additional consumers last year, 4027 were of the ordinary kind, and 17,307 of the new class. The number of cooking-stoves lent gratuitously has also notably increased. From 151,694 on Dec. 31, 1893, it had risen to 174,947 at the close of the past year—a difference of 23,253, or 1919 more than the total of the new customers placed upon the books. The number of public lamps in use on Dec. 31 last was 85,968, of which 73,763 were employed for lighting the city. Some changes have been made in the high-power burners used in the lamps fixed in the open spaces and principal streets of the city; the total number being increased by 190 as compared with those in use at the close of 1893. Among the private consumers, however, there has been a falling off to the extent of 356 in regard to these burners. The total number employed on Dec. 31 last was 4470, corresponding to 25,780 jets of the ordinary kind, as compared with 4636, equal to 29,789 jets, at the end of 1893. The number of rising mains fixed during the past year was 1282, as against 1874 in 1893. The difference is accounted for by the fact that greater efforts have been made to bring in the smaller consumers—to whom the facilities already mentioned have lately been afforded, and who occupy apartments in houses furnished with rising mains and gas-fittings—than to seek new buildings in which to instal these pipes. Of the 17,307 new consumers which have resulted from the introduction of the new arrangement, 16,355 take their supply from rising mains actually fixed, and 952 from new mains. There are in Paris 605,000 apartments of an annual rental value below 500 frs.; and at the beginning of August last, when the new system came into operation, the Company had only 14,952 consumers from this class of tenement. The 17,307 since added bring the number up to 32,259; but it falls far short of the figure the Directors hope to reach. The total number of rising mains in use at the close of last year was 37,650, distributed over 29,121 houses. The number of consumers taking gas therefrom was 153,555; being an increase of 20,087 on the total at the end of 1893. With the view of extending the use of gas for lighting and heating purposes, the Directors have introduced the plan of offering premiums, similar to those given in connection with the intallation of gas-engines, when the quantity of gas consumed in a year exceeds a certain figure. With regard to the Company's works, no important extensions of plant were made during 1894; but the distributing system was increased to the extent of 23,890 metres, or about 26,200 yards. This addition brought up the total length of mains to 2,355,993 metres, or about 1464 miles.

From the financial portion of the report, we learn that a net sum of 3,610,910 frs. (£144,436) was expended last year on capital account, of which the greater part was for rising mains, service-pipes, and meters. The capital account stood as follows on Dec. 31, 1894:—

	Francs.		Sterling.
Amount expended to Dec. 31, 1893	294,674,162	..	£11,786,966
Do. do. during 1894	3,610,910	..	144,436
Total	298,285,072	..	£11,931,402

To meet this there has been raised: By shares, 84,000,000 frs.; by bonds, 221,185,689 frs.—together, 305,185,689 frs. (£12,207,427)—leaving an unexpended balance of 6,900,617 frs. (£276,025). This is exclusive of a sum of 16,800 frs. remaining to be paid upon bonds. The capital is represented by 336,000 shares and 473,332 bonds. Up to the close of last year, there had been redeemed 163,643 shares and 187,190 bonds; so that 172,357 shares and 286,142 bonds remain to be redeemed before the expiration of the concession in 1905.

The following is the working account for the past year:—

Expenditure.

	Francs.		Sterling.
Value of gas in store on Jan. 1, 1894	43,480	..	£1,739
Manufacture of gas—			
Coals carbonized	20,214,487	..	808,579
Coke and tar for heating purposes	4,214,939	..	168,598
Salaries and wages	4,759,042	..	190,362
Maintenance of works and plant	1,571,245	..	62,850
Incidental expenses of carbonization	1,478,722	..	59,149
Purifying materials and labour	396,612	..	15,864
Distribution—			
Salaries of engineers and officers	2,039,327	..	81,573
Repairs, &c., of mains and services	1,417,972	..	56,719
Miscellaneous expenses, stamps, &c.	416,228	..	16,649
General management—			
Directors and Executive Committee	300,000	..	12,000
Salaries	1,268,461	..	50,738
Office and other expenses	540,188	..	21,607
Service, accidents, relief, &c.	243,062	..	9,723
Law and other charges	60,730	..	2,429
Bad debts	10,379	..	415
Rents and insurances	316,587	..	12,664
Interest on loans	7,104,937	..	284,197
Loan redemption fund	10,507,500	..	420,300
Share redemption fund	2,888,750	..	115,550
Cost of experiments, &c.	224,591	..	8,984
Sundry works	233,899	..	9,356
Pension and provident funds	1,530,243	..	61,210
Municipal charges—			
Tax of 2 c. per cub. met. of gas sold	5,198,044	..	207,922
Rent of subsoil occupied by mains, &c.	200,000	..	8,000
Lighting, extinguishing, and maintenance of public lamps (less amount paid by Municipality)	1,186,937	..	47,477
State charges—			
Official gas testing, stamps, &c.	1,124,863	..	44,995
Total expenditure	69,491,225	..	£2,779,649

Revenue.

	Francs.		Sterling.
Value of gas in store on Dec. 31, 1894	49,630	..	£1,985
Sale of gas	77,098,549	..	3,083,942
Residual products—			
Coke	12,070,754	..	482,830
Tar	1,920,305	..	76,812
Ammoniacal liquor	1,847,780	..	73,911
Rental of meters and fittings on hire	3,408,951	..	136,358
Fire-bricks, &c.	64,460	..	2,579
Interest and discount	805,048	..	32,202
Total revenue	97,265,477	..	£3,890,619
Deduct expenditure	69,491,225	..	2,779,649
Balance, profit for 1894	27,774,252	..	£1,110,970
Add balance of 1893 liquidation	224,164	..	8,966
	27,998,416	..	£1,119,936
Deduct to meet outstanding claims	298,416	..	11,936
Balance available for distribution	27,700,000	..	£1,108,000
Deduct for share dividend	11,200,000	..	448,000
Balance, divisible equally between the Company and the Municipality	16,500,000	..	£660,000

The total amount available for distribution among the shareholders is therefore as follows:—

	Francs.		Sterling.
Dividend as above	11,200,000	..	£448,000
Half of divisible balance	8,250,000	..	330,000
Portion of annuity (now compounded) payable by Municipality	50,000	..	2,000
Balance of undivided profits	71,684	..	2,867
Total	19,571,684	..	£782,867
Deduct 1 fr. per share for reserve fund	336,000	..	13,440
Balance	19,235,684	..	£769,427
Deduct interim dividend of 12 frs. 50 c. per share paid in October last	2,298,900	..	91,956
Balance available for final dividend	16,936,784	..	£677,471

The balance allowed of a further payment of 50 frs. per share (£10); making in all 62 frs. 50c. (£2 10s.), and leaving 136,783 frs. (£5471) to be carried forward. The dividend is lower by 1 fr. 50c. than it was for 1893, and by 9 frs. 50c. than for 1892. It is explained that the diminished dividend for last year has been caused mainly by the appropriation of the amount intended to form the reserve of the employees' pension fund, as the decreased receipts from the sale of gas and coke were to a very large extent compensated for by practically equal reductions of expenditure. The present is the first occasion that the results of the working have been prejudicially affected by the withdrawal of this sum.

With regard to residuals, the sale of coke produced last year 12,070,754 frs.; being 2,305,408 frs. less than in 1893. The stock at the close of the year was about the same as it was at the corresponding time in 1893; but the exceptionally severe weather of February last caused a considerable diminution. Tar and chemical products yielded a return of 3,768,085 frs., as compared with 3,263,259 frs. in 1893—an increase of 504,826 frs. The sale of gas heating appliances rose very appreciably last year. This was possibly owing to the attractiveness of the Company's various show-rooms, which were visited by no fewer

than 61,143 persons—the orders despatched numbering 7518. The Company's officers attended to 7663 requests sent in by parties desiring information at their own homes. With respect to the use of gas for motive power, 196 engines were put up last year; representing 830-horse power. The total number of engines at work at the end of 1894 was 1996, equal to 6105-horse power. The annual consumption of gas in this way may be estimated at about 6,923,700 cubic metres, or about 244½ million cubic feet. Coke heating-stoves to the number of 1482 were sold in 1894, as compared with 1167 in 1893. This increase is accounted for by the reduction made in the price of these appliances, as intimated in the previous report; and the Directors hope it may be even greater in the future.

Full particulars are, as usual, given in regard to the provident, pension, and other funds connected with the Company. The only reference to the price of gas is an announcement, towards the close of the report, of a probable reduction, during the current year, in the charge made in certain communes where the figures are rather higher than those for Paris. The General Council have expressed a wish that the prices should be lowered; and the matter has been brought before the Directors by the Prefect of the Seine. They consider that the sacrifice they are prepared to make will be compensated for by increased consumption; and, moreover, it will give satisfaction to the Council, and render more uniform the conditions of supply.

THE LEICESTER CORPORATION GAS COMMITTEE AND ELECTRIC LIGHTING.

Inauguration of the Works.

The electric lighting works of the Leicester Corporation have been completed; and their formal inauguration took place on Thursday last. This event and the plant itself deserve rather longer notice than installations of the same character, but existing under different circumstances, warrant us in giving, and for these reasons: The site of the station is at the Aylestone Road Gas-Works; it has been placed under the control of the Corporation Gas Committee; and the credit for its design and successful construction and equipment is unreservedly given by all who have taken any part in the work to the Gas Engineer (Mr. Alfred Colson), and upon that gentleman rests the responsibility of its future management. Besides this the fuel used in the generation of the steam for driving the engines is coke from the gas-works. It will therefore be seen that the installation has peculiar attractions for gas engineers generally; and its future will no doubt be watched by them with keen interest.

The invitations issued by Mr. Alderman Lennard, the Chairman of the Gas and Electric Lighting Committee, for Thursday's ceremony numbered about 170, and there were very few absentees—among the guests being Sir Courtenay Boyle, K.C.B., the Permanent Secretary to the Board of Trade; Mr. Charles Hunt, of Birmingham; and Mr. R. O. Paterson, of Cheltenham. Having assembled, the company first visited the station, which is a red brick structure, corresponding in its general features with the buildings of the gas-works, and comprises vestibule, engine and dynamo room, boiler-house, office, and testing room. The system which has been adopted is the high-tension alternating current, with street transformers, and low-tension distribution. The engine and dynamo room is 114 feet long, 40 feet wide, and 31 ft. 6 in. high. It contains three Mordey-Victoria alternators, each of 200 kilowatts capacity, coupled direct to three horizontal compound condensing engines, each of 350 indicated horse power. In addition to the large alternators, there is also a small machine intended for the night or day load. This has a capacity of 75 kilowatts, and is driven by a 135 indicated horse power engine. The exciters consist of two Victoria continuous current dynamos, each of 13 kilowatts capacity. The room being cellared, enables the whole of the steam-pipes, air-pumps, steam receivers, traps, &c., to be kept conveniently out of sight, and also affords every facility for making the various electrical connections, &c., and gives ready access to the lower portions of the armature. A 15-ton overhead crane traverses the length of the room; and this can be worked either electrically or by hand. The boiler-house, which stands at the rear of the main building, contains four of Babcock and Wilcox's tubular boilers, each of 250 nominal horse power, and working at 120 lbs. pressure. Foundations are already in for two more boilers of like size. The draught is obtained from a stack 125 feet high. On either side of the station are railway lines in direct communication with the sidings at the gas-works. At present the station is lighted by incandescent gas-lights; but these are to be replaced in the near future by electric lamps. Passing to the distribution system, the cables, both high and low tension, are concentric in form, and lead covered and armoured. The transformer chambers are eight in number, and are perfectly water and gas tight. All the chambers have an air inlet and outlet for securing proper ventilation; and the bell mouths of the pipes carrying the high-tension mains are caulked with vulcan cement, with the object of preventing any gas finding its way into the chambers. As an additional precaution against this occurring, the pipes are provided with a ½-inch hole about a foot from the back of the wall of the chamber, which communicates with a ventilating-flue. This arrangement allows of any gas which finds its way into the pipe escaping before reaching the chamber. A similar arrangement, with the same object, is provided in connection with the low-tension cables. The contractors for the whole of the electric lighting plant and boilers were the Brush Engineering Company; but the order for the engines was ultimately placed with Messrs. Hicks, Hargreaves, and Co., of Bolton. Speaking of the installation as a whole, it may be said that Mr. Colson has maintained his reputation for efficiency and thoroughly good work. Athough the official inauguration only took place last week, the light was first supplied on Dec. 19 last. The total number of meters fixed is 91; and the lamps wired are equal to 6000 of 8-candle power. The price at present charged for the current is 6d. per unit.

During the inspection of the plant,

Mr. G. K. Billings, the Vice-Chairman of the Gas and Electric Lighting Committee, claimed the attention of the company. He said he had to offer, on behalf of his colleagues, their heartiest congratulations to their Chairman on this auspicious event. Mr. Alderman Lennard had been Chairman of the Committee for six years; and anyone looking round the works must see in their magnitude—especially in the gas-works—that there was quite sufficient for one Chairman to attend to. For upwards of two-and-a-half years, Alderman Lennard, with his colleagues and their Engineer, had been thoroughly investigating all sources of information regarding electric lighting; and it had been their desire to place such an installation in Leicester as would be a credit to all concerned in its establishment.

Alderman Lennard thanked Mr. Billings for his kind words, and then proceeded to give some information respecting the plant. Part of his remarks is covered by the description already given. In addition, he stated that the total indicated horse power of the four engines was 1185. The three large alternators were each capable of giving off electric current for the supply of 3300 16-candle power lamps; and the small one, for 1200 lamps. So that the plant was capable of supplying a total of 11,100 16-candle power lamps. The effective capacity was only equal to 8000 lamps, as they reckoned to have a reserve of one machine. The current was generated in the machines at a voltage of 2000; and this was reduced to 100 volts in the transformer chambers in the town. They had no storage in the sense in which they could store gas. But if the boilers were cold, they could convert coal into electric current, and light their customers' dwellings in a little more than an hour. Therefore their reserve power laid in the coal stack. One feature of the machinery was that it was direct driving. When they visited the Continent some three years ago, the system of direct driving was the one most adopted; and he believed their Engineer was the first in this country to produce a plan on this principle. It was quite true that it was a long time before it was passed by the Town Council, and in the meantime another town adopted it. But the first system on this plan in this country was drawn in their gas office, and was the work of Mr. Colson. The building was designed by their Engineer, and erected entirely by the Corporation workmen. The site was admirably chosen. They had the waste fuel from the gas-works to burn under the boilers; and they had a water supply from the river close at hand, which saved them several hundred pounds a year. He concluded his remarks by declaring the station open.

The machinery, which had previously been stationary, was then set in motion, by Mrs. Lennard turning a small valve, amid the applause of those present.

The inspection of the plant being finished, the visitors passed to the workmen's reading and recreation room to enjoy the hospitality of Alderman Lennard and his colleagues. An excellent cold collation was served, which was followed by a number of toasts. The usual loyal toast having been disposed of, "The Corporation" was given by Mr. J. F. L. Rolleston, J.P., and responded to by the Mayor (Alderman G. Green), who, in the course of his remarks, eulogized the work of the Corporation Committees generally, and particularly that of the Gas Committee.

Mr. J. S. Raworth, the Chief Engineer of the Brush Company, proposed "The Gas Committee, and Success to the Electric Lighting Undertaking." He said he must admit that there was no electric lighting installation in this country in which he had been concerned that had been carried through in such a straightforward and businesslike manner as the Leicester undertaking. Most of those present had inspected the plant; and he thought they would have seen for themselves that success was going to attend the efforts of the Gas Committee and Mr. Colson. At the time of the meeting of the Institution of Gas Engineers at Leicester last year, the Journal of Gas Lighting stated that they saw the finger of Mr. Ferranti in this installation. That might have been so. Mr. Ferranti was quite capable of designing an installation like this one; but the man who designed it was the Committee's own Gas Engineer. In every matter connected with the work, he (Mr. Raworth) had simply been Mr. Colson's servant. He had given Mr. Colson what he wanted, and had done what he said; and the result was what was now to be seen. Of course, Mr. Colson had not told him how to design a dynamo or a switch; but he had instructed him to design the best, strongest, and most lasting dynamos and other plant that human ingenuity could devise. He must say that Mr. Colson was the first man he had yet met who had a clear understanding of his duties as a gas engineer. Why did they want gas engineers? They did not want them at all. They wanted someone to give them light; and, if they were using carburetted hydrogen, the moment a light could be produced with less poisonous products, it should be done. Mr. Colson had appreciated this fact from the first—that his function was not to poison the inhabitants of Leicester, but to give them the best light that he could possibly devise.

The toast having been honoured,

Alderman Lennard, in acknowledging it, said his Committee had had very large powers entrusted to them by the Council. They had the conduct of an undertaking with three-quarters of a million of capital, with 700 or 800 workpeople, and with a turnover of £200,000 a year. This was sometimes called a monopoly; but it was not so, as certainly one-half of their business was subject to the keenest competition. In the coke trade, and residuals and chemical manufacture, they were subject to close and keen competition; and therefore it would be readily understood that the Committee could not undertake the whole of the details of this great concern, as the members would never have any time for their own private business. What they did was to lay down the principle and policy on which the department should be worked; and then they entrusted it to their chief officer and his staff to carry out. There were ideas around them, which were being advocated with more or less persistency, that gas and electric lighting committees were a proof that all industries could be municipalized and socialized; and there was a belief that they had only to municipalize, and that everybody should be consulted about everything, to have perfection and the millennium. He believed in municipalizing, industries of this kind; but he did not believe in a good deal of the nonsense that was being preached. He and his Committee believed in authority and order, in paying according to merit and value of services, and in giving their men a good environment—such as the reading and recreation room, the gardens, bath-room, mess room, and lavatories. In all their work, they had an indefatigable and highly capable officer in

Mr. Colson; and he (Alderman Lennard) would be failing in his duty if he neglected to acknowledge the splendid service he unstintingly gave to the town. With respect to the second part of the toast, as early as 1878, when the Corporation took over the gas-works, they looked so far forward in the future as to get a clause inserted in their Act giving them the sole control of the supply of electric current for all purposes in the town. Having referred to the powers obtained by the Corporation in 1883 and 1890, he said they had now one of the finest electric lighting stations in the country, and at a very moderate cost indeed. Their borrowing powers were £42,000; but they had only spent something like £33,000. A reference to the accounts which were published in connection with these undertakings would show that they were the only Corporation in the country who had not exceeded their estimates in capital expenditure. They had also passed through the year of installation, with all its numerous expenses, and had come out at Christmas last with a small balance to their credit, which they had carried over to this year. They had plant of a capacity for 11,000 16-candle power lamps; and they had already installed in the town lamps equal to 6000 of 8-candle power, which was more than one-third of their effective capacity. They had where they were assembled an ideal combination. They had what the Board of Trade had officially reported as "model" gas and chemical works. Now they had added electric lighting works; and he did not think the Board would have to alter their report on that account. They had present that day, representatives of gas and electrical technical journals; and they had extreme partizans of both lights. The electric light partizan would say gas was an antiquated and poisonous mode of lighting; and the gas people would put down the electric light as a costly and dangerous method of illumination. He and his Committee did not agree with either of those partizan views; and they would give a fair field and no favour to both lights. Here he mentioned an interesting fact. The demand, he said, for gas for cooking and for motive power had so increased that they each absorbed 10 per cent. of the total output of gas. In conclusion, he remarked that, as to the future of the electric lighting undertaking, they had no fear.

Sir Thomas Wright, in an eloquent speech, next proposed "Trade and Commerce."

Sir Courtenay Boyle was called upon to respond. He expressed his pleasure at being present that day, because it devolved upon him in 1889 to advise the Board of Trade with regard to the granting of the Provisional Order under which the Corporation were now acting; and it seemed to him apposite to have to take part in the completion of the works. They had heard a great deal of the municipalization of such undertakings as this; and all he could say was that up to the present such action had been achieved by municipal bodies like the Leicester Corporation without any impairment of that individual energy to which our trade and commerce owed so much. That electricity had an enormous future—a perfectly unknown future—he was confident. His subsequent remarks were mainly directed to the recent industrial dispute in the town.

Alderman Wood gave the toast "The Contractors and Engineers." He referred to the past history of the gas undertaking, and said that, when Mr. Robinson resigned the position of Manager, they found their present Engineer in the "Metropolis of the Midlands." Although his friend Mr. Charles Hunt then lost a very valuable colleague, he must now rejoice when he observed the great works that Mr. Colson had since carried out so successfully in Leicester.

Mr. Colson, who was heartily received, acknowledged the very generous way in which he had been referred to, and spoke of the invaluable aid which he had received from the contractors in carrying out the new works.

Mr. Hudson (of Messrs. Hicks, Hargreaves, and Co.) responded for the contractors.

The final toast was "The Health of the Chairman and Host, Mr. Alderman Lennard."

At intervals during the proceedings, the Gas-Works Band played some popular selections of music.

INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

A Scheme of Reconstruction—Rejection by the Ordinary Shareholders.

Extraordinary Meetings of the holders of preference and ordinary shares in the above Company were held yesterday week, at the Cannon Street Hotel, E.C.—Major-General Beresford in the chair—to consider a scheme of reconstruction which has been framed by the Committee of shareholders appointed, at the meeting of the Company on March 21, to discuss with the Directors the proposals of Mr. A. J Bethell as to the re-organization of the capital.

The reconstruction scheme provided for the formation of a new Company, to be called the Incandescent Gas-Light Company, Limited, with a capital of £500,000 divided into 500,000 shares of £1 each, and with the object of acquiring the assets and liabilities of the old Company. The Liquidator was to receive 448,235 shares in the new Company for distribution. To each of the preference shareholders in the old Company would be allotted 32 shares for each preference share held by him. This would absorb 298,848 shares, each of which would be issued fully paid, and without any liability for calls. To each of the ordinary shareholders would be allotted two-and-a-half shares (fully paid) for each ordinary share held. This would absorb 99,387 shares. The remaining 50,000 shares in the hands of the Liquidator would go to the Manager (Mr. Julius Moeller) in lieu of his share of the profits in the old Company. Mr. Moeller would bind himself to act as Manager for a period of at least three years, but without any restriction as to dealing with his shares. The issue of the balance of 51,765 shares was to be deferred for the present; but when issued they were to be offered to the shareholders *pro ratâ*. The Committee, in reporting upon the scheme, said they considered that, by the proposed arrangement, the ordinary shareholders would receive considerably more than they are at present entitled to, and more than they are likely to get on any adjustment in the future. The advantages are so great that the Committee considered it worth while for the preference shareholders to give up the amount proposed, which is comparatively small to the preference, but so large to the ordinary, shareholders. The preference shareholders would appear to be relinquishing a large amount; but the Committee pointed out that it was only 10 per cent. of their dividends, while they gained the following important advantages: (1) Doing away with the present uncertainty, as otherwise, until it has been decided by a Court of Law, no one can say for an absolute certainty that the position of the preference shareholders is impregnable. (2) The creation of one uniform class of shares, whose rights everyone can readily understand. (3) The obtaining of a Stock Exchange quotation and a free market for the shares, with a close price for either sellers or buyers. (4) The cancellation of Mr. Moeller's agreement, which, however necessary it may have been in the past, cannot but be a difficulty in the way of the Company upon any enlargement of the present scope of its operations. (5) The power of readily obtaining increased working capital; thus avoiding the necessity of retaining money otherwise available for payment of dividends. (6) The cancellation of the rights of the ordinary shareholders to half the assets in the event of liquidation. There seemed to have been a good deal of misunderstanding as to the exact amount which would be received by each class of shareholders. To make this clear, the following calculations were given, based on a net divisible profit of £50,000 per annum—Division as at present: Available for distribution, £50,000; Mr. Moeller (20 per cent.), £10,000; available for dividend purposes, £40,000, of which nine-tenths go to the holders of the 9339 preference shares (viz., £36,000), and one-tenth to the holders of the 39,755 ordinary shares (viz., £4000). Division under the new scheme: To the old preference shareholders (holders of 298,848 new shares), £33,336; to the old ordinary shareholders (holders of 99,387 new shares), £10,977; to Mr. Moeller (holder of 50,000 new shares), £5676. As the preference shares would receive 32 new shares for one old share, and the ordinary receive two-and-a-half new shares for one old share, the comparative result would be as follows: Dividend payable to a preference shareholder under the old scheme, £3 17s. 1d.; under the new scheme, £3 11s. 4d. Dividend payable to an ordinary shareholder under the old scheme, 2s.; under the new scheme, 5s. 7d.

The meeting of the preference shareholders was first held.

The Chairman, having acknowledged the loyal manner in which the Committee had worked in the interests of the shareholders, spoke of the pending litigation—remarking that it could go on or be stopped. The litigation was of no material importance to the Directors; they stood or fell by what they had done. If the Court decided against the Directors, the preference shareholders would have the Directors' 3500 shares added to their own, provided the Company remained as now. If Mr. Bethell's scheme was carried, and the Company went into liquidation, and action was taken against the Directors, the 3500 shares would become part of the assets of the Company, and would be divided equally between the preference and ordinary shareholders. He believed that, if any scheme could be adopted which would settle the disputes between the two classes of shareholders, it would be for the benefit of the Company. He was also of opinion that any scheme which would make the shares of a greater marketable value would also be for the benefit of the Company. The Directors supported this scheme; and he therefore proposed a resolution sanctioning the agreement made between J. T. Helby, on behalf of the holders of preference shares, and G. E. Thompson, on behalf of the holders of ordinary shares, and directing that it be carried into effect.

Mr. Helby, in seconding the resolution, admitted that he and his colleagues had been treated in a most considerate way by the Directors. He enlarged upon the scheme; and then proceeded to compare it with an alternative plan proposed by a Mr. Pond, who, he stated, was merely the paid advocate of certain shareholders. Referring to the conversion of Mr. Moeller's interest in the Company, he said there was no doubt that that gentleman was giving up a very large amount; but he was willing to do this in the interest of the Company. One great advantage to be derived from the scheme was that they would get a marketable value for their shares on the Stock Exchange; for they would have a quotation. At the present time, they practically had no quotation; and, of course, there was a difficulty in disposing of shares which had risen in value from 2s. to £36. In his opinion, the very best thing they could do was to adopt the scheme. It was true the preference shareholders gave something to the ordinary shareholders; but he thought they could afford to be generous, having regard to the price of the shares, and the profits the Company were now making. He understood there would be some opposition on the part of the ordinary shareholders. All he could say was that if they refused to accept this very generous offer, he hoped the preference shareholders would never again entertain the thought of reconstruction in the manner now proposed.

Mr. Wigan said, in his opinion, the scheme was too generous to the ordinary shareholders, for the preference shareholders were giving up much more than one-tenth of their dividends. Mr. Moeller was also apparently generous in surrendering £10,000 a year; but he was taking a perpetual annuity of £5000 a year in lieu of those profits. The ordinary shareholders obtained a great part of their benefit from that; but the preference shareholders were giving away the reversion they would be entitled to in the event of Mr. Moeller's death.

The Solicitor (Mr. Francis), replying to Mr. Morgan, said that Counsel had given it as their opinion that the scheme of reconstruction was absolutely legal.

Mr. Morgan said he disagreed with Counsel's opinion, and suggested that it would be inadvisable to pass any scheme of reconstruction until the litigation was at an end.

A Shareholder asked what objection Mr. Moeller had to retaining his 50,000 shares.

Mr. Moeller replied that he thought his investments in the incandescent light were big enough already. Personally he did not like the scheme, and would much prefer to receive 20 per cent. of the profits, and allow things to go on as they were, because he believed that the Company would be able to make £50,000 a year. He did not, however, want to stand in the way of reconstruction.

The resolution was subsequently put to the meeting, and carried.

A poll was demanded by Mr. Morgan; and the Chairman intimated

that it should be taken at the close of the meeting of the ordinary shareholders.

An Extraordinary Meeting of ordinary shareholders was then held.

The CHAIRMAN moved a resolution in the same terms as that submitted to the preference shareholders.

Mr. G. E. THOMPSON seconded the motion; and, in doing so, he remarked that the ordinary shareholders knew they were in a very unfortunate position—that they were receiving at the present moment scarcely any of the profits made by the Company. They had now the opportunity of increasing their share; and the question was whether they would avail themselves of it.

Mr. FOX, who had been elected to serve on the Committee, but had retired, explained that his reason for doing this was that he asked for information which would have had the effect of guiding him in exercising his voting power. But this information was, for some reason, refused; and under the circumstances he declined to advise the shareholders, or to exercise his voting power, until the information had been given him.

Mr. BASTARD objected to the capitalization of Mr. Moeller's interest. It seemed to him, as a business man, that it was impossible for any shareholder to arrive at what Mr. Moeller's interest ought to be until the accounts showing the profits of the Company were made out; and therefore he proposed that the meeting be adjourned until after the accounts for last year had been submitted to the shareholders.

Mr. BAKER seconded the amendment.

Mr. LINDO felt that, having trusted the Committee with the consideration of the scheme, it was advisable to accept their proposal. At the date that the scheme was propounded, the preference shares were worth £30; but they had since risen to £36, and the ordinary shares in proportion.

The SOLICITOR, answering an inquiry by Mr. Fox, said that any claims against the Directors or anybody else would, in the event of the shareholders passing the resolution, become the assets of the Company. If the Company went into liquidation, their claims would not be jeopardized at all.

On being put to the vote, the amendment was rejected; and the original resolution was also lost.

Mr. LINDO demanded a poll.

A poll of the preference shareholders was taken, with the result that 8160 votes were in favour of the resolution, and 60 against it. The resolution was therefore carried as far as the preference shareholders were concerned. The voting of the ordinary shareholders was as follows: For the resolution, 1903; against, 972.

The CHAIRMAN announced that, as there was not the necessary three-fourths majority required by the statute in favour of the resolution, the scheme fell through.

The proceedings, which lasted nearly four hours, then ended.

BOLTON CORPORATION GAS SUPPLY.

A Handsome Year's Profit—Reduction in Price.

At the Meeting of the Gas Committee of the Bolton Corporation last Saturday, the annual balance-sheet was under consideration. Alderman Miles, the Chairman of the Committee, presided; and a good deal of interest was taken in the proceedings, because it was known that, unless the Gas Department contributed a very substantial sum out of the profits made on the year's working, there would be an increase of something like 5d. in the pound in the borough rate. The Committee had been approached on the subject, and also with regard to a reduction in the price of gas. They were able, in consequence of a very successful year's operations, to do both. The profit on the year amounted to £60,342, which with bank interest and charge on mains gave a total on the credit side of £60,767. The disbursements included £14,460 for annuities, £2456 as interest on loans, £4060 dividend on Corporation stock, and £1504 for the sinking fund. After meeting other charges, there was left an available balance of £38,251; and out of this the Committee decided to recommend the Council to apportion £23,478 in relief of local rating, which is equal to a 14d. rate—the difference of £14,773 to be set apart for the renewal of works and plant. Out of the latter sum, £5000 has to go to meet depreciation of works. Last year, the Gas Department contributed £16,960 in relief of the rates, and placed £12,208 to the reserve fund. The Committee also decided to recommend the Council to reduce the price of gas by 2d. per 1000 cubic feet, making it 3s., as was the case prior to 1890. This reduction equals £6600. The balance-sheet (an advance proof of which was supplied to our representative by Alderman Miles) shows that the amount received in the past financial year for the sale of gas aggregated £122,635, less £18,579 for discounts; the total quantity of gas consumed being 769,327,000 cubic feet, of which 714,138,000 cubic feet were for private persons, and the remainder for public lamps. The receipts for residual products were as under: Coke, less labour and cartage, £13,208, as against £14,693 last year; tar, less wages and loading, £5156, as against £3734; sulphate of ammonia (net) £8972, as against £10,242 in the previous twelve months. Under the head of "manufacture of gas," the disbursements totalled £62,392; distribution charges, £5340; rents, rates, and taxes, £3976; management, £1745; cooking and heating apparatus, £284; law and parliamentary charges, £51; and bad debts, £209. The gross expenditure was £74,000, as against £82,475 last year. The electric supply fund account shows a loss of £508. The balance-sheet and recommendations of the Committee will be brought before the Council to-morrow.

The Sheffield Gas Company Assists the Corporation.—Mr. Hanbury Thomas, the General Manager of the Sheffield United Gas Company, has, with the sanction of his Directors, been able to make arrangements whereby a number of the Company's men have been told off to assist the Corporation in their present difficulty with the water distribution system, consequent upon the frost of the past winter. The men commenced work yesterday week, increasing the gangs engaged in repairing fractured pipes to nearly 500.

ROCHDALE CORPORATION GAS AND WATER DEPARTMENTS.

Financial Reports.

The balance-sheet of the Rochdale Corporation Gas Committee for the past financial year is eminently satisfactory. It shows a gross profit of £13,118; but from this there is to be taken £3000 for the reserve fund, and £1928 owing to last year's rating—thus leaving £8190 as the net surplus available for the purpose of reducing the rates. The net surpluses in the ten previous years were: 1885, £12,190; 1886, £10,322; 1887, £12,128; 1888, £15,502; 1889, £12,963; 1890, £13,576; 1891, £9041; 1892, £4546; 1893, £4289; and 1894, £3809. The income of the department during the last twelvemonth has amounted to £68,340—an increase of £4995. There was an advance of £6106 in the gas-rental; and, with the exception of coke, the residuals have proved more productive than they were in the previous year. On the coke account, the receipts have fallen by above £1600, which is mainly due to the great decline in the selling price. During 1893-4, the coal strike forced the price up as high as 1s. per cwt.; but through the past twelve months, it has been normal. As to other residuals, there is an improvement of nearly £900 in the receipts for the products of the distillation of tar, and a reduction of £350 on the takings for sulphate of ammonia. Including the allowance of £3000 to the reserve fund, the total expenditure amounts to £58,222, against £59,535 in the previous year—a reduction of £1313. Twelve months ago, and for several years prior to that time, the sum transferred from profits to the reserve fund was only £1500. The diminished expenditure this year is entirely due to the great reduction in the price of coal.

The Water Committee's balance-sheet shows a deficiency of £6899, against £7090 last year—a decrease of £191. In relation to this matter, it is gratifying to notice the gradual diminution in the reported loss on the undertaking during the past decade. In 1886, the deficiency was £16,654; in 1887, £14,508; 1888, £12,842; 1889, £12,732; 1890, £10,200; 1891, £9319; 1892, £7764; 1893, £7725; 1894, £7090; and 1895, £6899. In connection with the improvement to the extent of only £191, it should be borne in mind that the extraordinary severity of the past winter necessitated extra expenditure on repairs to works, mains, and services, and that during the past twelve months the charges on the department for rents, rates, taxes, &c., have been considerably increased. Under these two heads alone, the extra expenditure has amounted to no less than £610—the increase in repairs having been £239; and in rents, &c., £371. The revenue shows fairly satisfactory progress; its total being £30,226, against £29,769. The expenditure in relation to annuities, dividends on stock, and sinking fund has satisfactorily decreased; the figures being £29,427, against £29,875. The water-rental charged upon rateable value has produced £24,276—an increase of £444 during the year. The deficiency of £6899 will have to be made up out of the borough rate; and it represents about 6½d. in the pound.

ROTHERHAM CORPORATION GAS AND WATER DEPARTMENTS.

The Borough Accountant's Annual Report.

Mr. C. H. Moss, the Borough Accountant of Rotherham, has presented to the Finance Committee his report on the accounts of the various Corporation Departments for the year ending March 25 last.

With regard to the gas undertaking, Mr. Moss says the income again shows an upward movement; the sales of gas having been £1584 more than in the previous year. The coke sales have produced less than in the preceding year; but other residuals have about made up the deficiency. With regard to expenditure, a considerable saving is shown on comparison with 1883-4. Coal and other manufacturing charges have been £1822 less; and the expense of renewals has diminished by £489. The cost of public lighting and rates and taxes has, on the other hand, increased. The result of the year, after paying loan charges and allowing gas for public lighting without charge, is a surplus of £1049. The amount would have been larger but for the loss on coke sold at a low rate to poor people during the frost. This loss, and expenses of distribution, amounted to £159. Deducting the surplus from the previous year's deficit, there is still a debit balance of £1106 to carry forward.

The income of the water undertaking has again increased in a very satisfactory manner; the domestic water-rents having improved to the extent of £186 as compared with 1893-4, while the income from meter accounts has also advanced by £212. The expenditure of the year has been heavy, and includes some extraordinary items—such as additional outlay in consequence of the severe frost, £111; boring at Ulley and Dalton, £122; extra pumping at Ulley and Dalton, £185. The ordinary pumping expenses show a decrease; but other items are heavy. The final result of the year, after payment of interest on loans and sinking fund charges, is a deficit of £93. This amount added to the previous year's deficit makes a debit balance of £721.

Huddersfield Corporation Gas-Works.—The common seal of the Borough of Huddersfield has been affixed to a new lease of the gas-works land, from Sir J. W. Ramsden, for 999 years.

Messrs. Crossley Bros., Limited, have received the first award for oil-engines at the Hobart Town (Tasmania) Exhibition, a notice of which appeared in the JOURNAL for the 19th ult. (p. 607).

The Price of Gas Question at Ossett.—A public meeting of ratepayers was held at Ossett last Tuesday, to take into consideration the refusal of the Directors of the Gas Company to reduce the price of gas, and to take such action as might be deemed advisable. The Mayor (Alderman G. H. Wilson) presided; and there was a moderate attendance. Resolutions were unanimously passed, asking the Company to reduce the price to 2s. 6d. per 1000 cubic feet, and desiring the Corporation to make inquiries as to other towns where the gas-works had been municipalized. A further proposition was made that, failing compliance with the request for a reduction within fourteen days, the ratepayers present pledged themselves to cease burning gas. This was declared carried; but a good many refrained from voting.

SOUTHWARK AND VAUXHALL WATER COMPANY.

Special Meetings of the holders of the 4, 4¼, and 4½ per cent. debenture stocks of this Company were held at the Offices, Southwark Bridge Road, on Tuesday last, for the purpose of considering the provision for the consolidation of the debenture stocks of the Company into one debenture stock, under the name of "Debenture Stock A," of one class, and bearing an uniform rate of interest not exceeding 4 per cent. per annum, under the provisions of the Company's Act of 1894. Alderman Sir H. E. KNIGHT presided.

The SECRETARY (Mr. Alfred Jelley) having read the notice of meeting,

The CHAIRMAN said he was not surprised at finding such a small number of debenture stockholders present, because the matter was fully explained in the circular which had been forwarded to them; and they were evidently so thoroughly satisfied that, although they were not present in person, they were so by proxy to a large extent—about 30 per cent. of the debenture stockholders of each class having sent in their proxies. By the proposed consolidation of the stocks, dealings would be far more easy. They had now £566,000 of 4 per cent., £94,000 of 4¼ per cent., and £260,000 of 4½ per cent. debenture stock. Under their Act of 1891, they had to issue a further amount of 4 per cent. debenture stock, to produce £83,000 with the premiums; and this would require the issue of about £65,000 of this stock, so that there would then be £630,000 of the present 4 per cent. debenture stock. It was undesirable that they should only have a Stock Exchange quotation for their 4½ per cent. debenture stock, which was only a very small proportion of the whole of these stocks. They had applied to the Stock Exchange for a quotation of the 4 and 4¼ per cent. stocks; but the Committee declined, stating that there were so many lines in the Official List that they could not give the Company another. Confusion arose in connection with dealings, as to which of the debenture stocks had been purchased, when the quotations appeared; and it was desirable to remove such confusion. Being in Parliament last year, they took the opportunity of introducing into their Bill clauses which had enabled this desirable result to be achieved. Parliament was exceedingly jealous in these matters, and required to be thoroughly satisfied—and was so satisfied—that, in the proposal which was being made by the Directors, the debenture stockholders would be affected neither adversely nor advantageously. Although the holders of 4¼ and 4½ per cent. stocks would receive an increased amount of the 4 per cent. consolidated stock, they would have precisely the same income as before, and be in exactly the same position. They might rest assured that Parliament had taken care that no damage was sustained by them, or advantage given to them, by the consolidation. He concluded by moving a resolution approving the proposal, so far as it related to, or affected the 4 per cent. debenture stock. He added that Parliament had provided that three meetings of the debenture stockholders of the Company should be held; and this was perfectly right, in order that every class affected might have the opportunity of expressing its view of the proposal.

Mr. C. M. VIALLS seconded the motion.

The CHAIRMAN, in answer to a question, stated that when the present three stocks were consolidated, the one stock which would then exist would be quoted on the Stock Exchange. That would be a gain in one sense to the present 4 per cent. stockholders; but it would be no real advantage. Mr. Vialls called his attention to one point. He had not himself alluded to fractions, because he thought that this matter was made clear in the printed paper which had been forwarded to the debenture stockholders. Having read the paragraph from the Act referring to the way in which the fractions would be dealt with, he put the resolution, which was carried unanimously.

On the motion of the CHAIRMAN, seconded by Mr. VIALLS, a similar resolution was also passed at meetings held subsequently of the 4¼ and 4½ per cent. debenture stockholders.

The proceedings then terminated.

ANTWERP WATER-WORKS COMPANY, LIMITED.

The Annual Meeting of this Company was held last Thursday, at the Offices, 86, Cannon Street, E.C.—Mr. D. EVANS presiding.

The SECRETARY (Mr. J. M. Hamilton) read the notice calling the meeting; and the report and accounts were then submitted. The income from all sources amounted to £31,478, as compared with £27,785 in 1893. After deducting working expenses, the cost of laying on services, and debenture interest, the net revenue for the year was £16,195. Adding the balance of £210 brought forward, and charging the contribution to the reserve fund of 5 per cent. on the net profits, there was then left for distribution the sum of £15,596.

The CHAIRMAN said the statement of their Manager (Mr. Ad. Kemna) showed that the Company had had a very satisfactory year. A sum of £268 had been received from the town for services that had been undercharged for a number of years. During the year, the Company had also largely benefited by the Antwerp Exhibition; and from this source they had to report a profit of 30,000 frs., or £1200. They could not, of course, expect such another windfall in the current year; and consequently the shareholders must make up their minds that no increase of revenue would take place next year—indeed, it might happen that pecuniarily they would not be so favourably situated. Upon this, however, he, of course, was not certain; for, as a *per contra* (which might not occur next year), they had to consider the extra outlay caused by the recent frost. The unusual severity of the weather had also prevented a number of customers from consuming their normal supply. So far the first quarter of this year showed that the revenue was increasing satisfactorily. He concluded by moving that the report and accounts be adopted; that out of the balance of profit a sum of £2500 be appropriated for the sinking fund, and £446 additional for the reserve fund; and that a dividend of 4 per cent. be paid, free of income-tax.

Mr. W. BLABER seconded the motion.

Mr. E. A. HANKEY took exception to the item appearing in the list of the Company's investments—"Chicago, St. Paul, and Kansas City 5 per cent. priority sterling bonds." Looking at the past history of these bonds, he did not think the security was precisely the kind in which the redemption fund of the Company should be invested.

The CHAIRMAN said the investment had been made on the recommendation of the Company's brokers; but he promised to look into the matter. Replying to Mr. Weir, he stated that they had not been placing a sufficient sum to the amortization fund to secure the whole of the amount of the capital at the end of the term of their concession. They required for this purpose to put aside £4000 a year. Before paying more than 4 per cent. dividend, the Directors would put by a sufficient sum yearly to secure the redemption of the whole amount.

After further discussion, the report was unanimously adopted.

The retiring Directors and the Auditors having been re-elected,

Mr. KEMNA made some remarks as to his experience with the supply of water at Antwerp during the severe weather in the past winter. It appeared that, to prevent freezing, the water at the pumping-station was raised in temperature by 10° Fahr., the greater part of which, however, was lost by the time the water reached the farthest end of the town. The quantity of coal used in the 24 hours for heating the amount of water required was 12 to 13 tons. The increased expenditure at the pumping-station had been 6300 frs. (about £250), which included, besides the coal, the cost of the extra labour employed. The total additional cost which might be attributed, directly or indirectly, to the frost would not exceed £400. One lesson the frost had taught him was that the dead-ends of the mains must be connected.

The usual complimentary votes terminated the proceedings.

THE NEW WATER-WORKS FOR MALVERN.

Last Tuesday, Malvern was honoured by a visit of Her Roya Highness the Duchess of Teck, for the purpose of opening the new water-works, which have been completed at a cost of about £52,000. The day was generally observed as a holiday; and the town presented an animated appearance. Her Royal Highness was accompanied by the Duke of Teck, Earl Beauchamp, and other notabilities. At the entrance to the works, the Royal party were received by Dr. Pike, the Chairman of the District Council, who read an address of welcome, to which the Duke of Teck replied. The Duchess then turned on the water, amid rounds of cheers. Those who had taken part in the brief ceremony then returned through the town to the Assembly Rooms for luncheon. Among the toasts which followed was "Success to the Malvern Water-Works," which was acknowledged by Dr. Pike and Mr. W. R. Copland (the Engineer). In the evening, there was a torchlight procession and a display of fireworks.

The question of an improved supply of water for Malvern is not by any means a new one. As far back as 1868, Mr. Bateman advised the Local Board to adopt means for intercepting the water on the hills, and carrying it to a reservoir at the British Camp, whence it would gravitate to the town—a distance of between four and five miles. The expense of this plan was estimated at £30,000; and the scheme was deemed too costly. Various expedients of a more or less temporary character were resorted to from time to time; but the great drought of 1887 convinced the Board that these could not with safety be any longer relied upon. Mr. Hawksley, Mr. Mansergh, Mr. Pole, and other engineers were consulted; and all of them advised pumping water from the red sandstone. These schemes did not commend themselves to the authority or the inhabitants; and in 1890 Mr. Copland was called in. Having carefully considered, in conjunction with Professor Symons, the water-bearing sources of the district, Mr. Copland reported in favour of a scheme similar in its main features to that recommended twenty-five years before by Mr. Bateman. It is this scheme which has now been successfully brought to a conclusion. The Engineer's original estimate was £36,000; and the actual outlay on the works has but little exceeded this amount. The legal costs, parliamentary expenses, purchase of land, &c., has brought the entire outlay to above £50,000. The work was begun in February, 1892, and the certificate of completion is dated Aug. 1, 1894. The British Camp reservoir has a storage capacity of 44½ million gallons; and there are two other reservoirs—making a total storage exceeding 46 million gallons. The area of the land drained is 387 acres.

THE WATER SUPPLY OF LIVERPOOL.

Serious Effects of the Late Frost.

At last week's Meeting of the Liverpool Corporation Water Committee, the Chairman (Alderman T. Hughes) remarked that there had been an increased consumption of water during the previous week compared with the corresponding period last year; but for several weeks the Engineer had thought it desirable to turn off the water at night in certain districts in consequence of the repairs following on the recent frost not having been completed. He had, however, now resumed a continuous supply in the whole of the districts—causing an increased consumption as the result of many of the repairs even then not being accomplished. Alderman Hughes thought that the experience of the past winter showed that a great deal would have to be done in the way of improving the branch-mains. Owners of property, he considered, would do well to look to their supply-pipes in connection with their houses; because the breaches caused were an inconvenience to their tenants, and also in view of the great amount of work which had to be done in connection with these repairs when frost came. It was highly desirable that owners of property should take a personal interest in the matter, and see that the branch-mains of their houses were laid in a proper way, rather than leave it to be found out when any defect arose after they had been frozen up.

Mr. J. Parry, the Water Engineer, submitted the following report on the effect of the late frost upon the distribution of water:—

"The damage done by the late frost to the distributing-mains of the Corporation and to the service-pipes of the water consumers has not yet been fully disclosed, as is evident from the high consumption of water

which still obtains, and which is chiefly due to hidden underground leakages, which the night inspectors have not yet been able to overtake. The effects of the frost have, however, been sufficiently dealt with, and ascertained, to enable the Water Engineer to report upon the subject in greater detail than has hitherto been practicable.

"The frost began to affect the water supply on Jan. 5; and the temperature remained below freezing point until the 13th, when a thaw set in, and a temperature above freezing point prevailed until Jan. 24, when a second and more severe period of frost began and continued until Feb. 23. Inconvenience from want of water through the frost was first experienced by the tenants of court houses, supplied by means of outside stand-pipes. There are altogether in the city 1030 courts, comprising 6180 houses, supplied in this manner. These stand-pipes, being fixed in the open courts, are easily affected by frost; and although the Corporation are not liable for their maintenance, at every period of frost a special gang of men is set apart to thaw and keep open for use the court stand-pipes, on which so many of the poorer classes are dependent for water. About twenty men were engaged upon this duty throughout the frost.

"Immediately after the temperature fell steadily below freezing-point, reports began to reach the water-works complaint-office from householders deprived of water. The staff of men told off to attend to these complaints was increased as the circumstances required; and when the complaints became numerous, the full organization arranged for periods of frost was put into operation. The area supplied was divided into districts; each district being under the charge of an inspector, assisted by as many men as were from time to time required to cope with the work. Instructions and reports were sent to and from districts through the private telephone exchange of the Corporation, by means of which the water offices can be placed in communication with all the bridewells, yards, pumping-stations, and other buildings belonging to the Corporation—thus effecting an enormous saving of time, and greatly increased efficiency. The district men were provided with portable stand-pipes to supply householders from the nearest hydrant or plug available; notice of the attendance of the men being given either by ringing a loud bell or by knocking at the doors. The maximum number of men employed upon this duty was 128.

"The total number of complaints of 'no water' which reached the water-works complaint-office throughout the two periods of frost was 4928; and it is estimated that there were, when the frost was at its greatest intensity, altogether about 27,000 houses without water, exclusive of the court houses already referred to. All these houses received a daily supply from the portable stand-pipes, except four blocks of houses in the suburban districts which were deprived of water in consequence of the freezing of the street-main, and which were therefore supplied by means of water-carts. With these few exceptions, the whole of the houses which were without water during the frost were deprived of their ordinary supply in consequence of the action of the frost upon the internal lead piping, or upon the lead communication-pipes between the mains and the houses. The satisfactory and gratifying fact that so few of the street-mains were affected by the frost, so as to be incapable of delivering water to the consumers, is to a large extent due to the depth at which pipes have been laid by the Corporation, and to the maintenance of a constant service in the districts; thus keeping a continuous flow through the distributing-mains.

"The maintenance of this constant supply would have been impossible without the assistance of the additional supply from Lake Vyrnwy; the maximum consumption during the period having amounted to 198,694,000 gallons per week, while the total quantity obtainable from Rivington and the wells is only 125,000,000 gallons.

"In addition to the men employed in supplying water to householders, about 200 men, including the city and dock turncocks, were engaged in packing and keeping free fire hydrants. This very important duty was so successfully accomplished that, although use was made of 80 hydrants for the purpose of extinguishing fires, in no case did the firemen experience the slightest difficulty or delay in attaching their hose and turning on the water.

"The total number of fractures of iron street-pipes by the frost was 407. Of these, 392 were small pipes from 3 to 5 inches in diameter; and they were nearly all pipes which had been very long in the ground, and were laid at shallow depths. The effects of the frost were chiefly felt upon the lead pipes belonging to the owners of the property supplied, and especially pipes in back passages, back yards, and outside water-closets. The number of private lead pipes reported as having burst at the water office was 17,070. The number of lead service-pipes burst between the mains and houses was 2466; making a total of the lead pipes burst 19,536. In addition to these burst pipes, more than 600 hydrants have been damaged by or during the frost.

"Consumers of water by meter were specially cautioned by a circular-letter issued early in the winter that their meters were liable to damage by frost if not carefully protected. Notwithstanding this warning, 115 meters out of a total of 1535 were injured by the frost, and have been repaired at the cost of the persons to whom they had been hired.

"The total expenditure incurred by the Committee in connection with the frost, and apart from the cost attending the additional consumption of water, has been £3904, made up as follows:—

	Cost exclusive of Paving.	Paving.	Total.
Wages to men giving supplies through stand-pipes, carts, &c.	£1506 12 2 ..	..	£1506 12 2
General repairs	1944 7 7 ..	£300 0 0 ..	2244 7 7
Stand-pipe repairs.	133 0 2 ..	20 0 0 ..	153 0 2
Total.	£3583 19 11 ..	£320 0 0 ..	£3903 19 11

The repairs and re-piping work still to be carried out to remedy defects caused or disclosed by the frost will involve a further expenditure of from £1500 to £2000.

"In concluding this brief statement of the effects of the frost so far as regards the distribution of water, the Engineer wishes to testify to the very efficient manner in which he has been assisted by his staff. The heaviest portion of the work necessarily fell upon the members of the permanent and regular staff; and these men spared no exertion, night or day, to fulfil their duties, and to assist the public in their difficulties."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners on Wednesday fixed their contracts for the year from Whitsunday next. Regarding their coal contracts, the requirements were 105,000 tons for the Edinburgh works, and 45,000 tons for the Leith works. The selections by Mr. Mitchell, of Edinburgh, comprised 29 varieties, at an average price of 12s. 5·2d. per ton; those by Mr. Linton, of Leith, included 12 varieties, at an average rate of 11s. 3·12d. per ton. Bailie Kinloch Anderson explained that the difference in the price of the coal for the two works would almost disappear when the returns for coke were taken into account. The Engineers, as in former years, have divided their coal into four classes. In the first, Mr. Mitchell takes 4000 tons at 21s. per ton; and Mr. Linton takes 3000 tons of the coal—one of the best cannels—at the same price. Of the second class—which are also cannels—Mr. Mitchell takes 51,000 tons, at prices varying from 12s. 6d. to 14s. 3d. per ton; and Mr. Linton, 20,000 tons, at from 12s. 6d. to 12s. 8d. per ton. Of the third class—also cannels—Mr. Mitchell takes 27,000 tons, at prices varying from 10s. 6d. to 13s. per ton; and Mr. Linton, 8000 tons, at from 10s. 6d. to 11s. 6d. per ton. Of the fourth class—a mixed lot—Mr. Mitchell takes 23,000 tons, at prices ranging between 7s. 2d. and 10s. 3d. per ton; and Mr. Linton, 14,000 tons, at from 7s. 2d. to 8s. 6d. per ton. When these prices are compared with those paid in the year 1891-92, it will be seen how great has been the fall in cannel—a result which is by many attributed to the advent of oil-gas manufacture. The highest priced cannel was then 35s. per ton, as compared with 21s. now; but that is not a fair comparison, as only a very small quantity of this coal was ordered. The average price of the first class in that year was 33s.; so that the fall for that class is really 12s. per ton. In that year the average price of the second class was 22s. 6d., and now it is only 12s. 7d. per ton. The third class in that year was 18s. 5d.; and it is now 11s. per ton. The fourth class was then 10s. 11d.; and it is now 8s. per ton. It will thus be seen that, while the first class has fallen 12s. per ton, the reduction in the second class has been 10s., in the third 7s. 5d., and in the fourth 2s. 11d. per ton—showing conclusively that it is the higher priced coals which have given way most.

In connection with the coal contracts, the interesting story was told that of one variety of coal two offers had been received, one from the colliery direct and the other from an agent in Edinburgh. The agent's tender having been 3d. per ton higher than that of the colliery owners, the latter was accepted; but on Wednesday forenoon the owners telegraphed withdrawing their offer. Bailie Kinloch Anderson said the owners seemed to have discovered that they were poaching in their agent's district. He, however, thought they had sufficient without the 2000 tons offered; and, as the Commissioners agreed, the contract has in that instance been lost.

In connection with the contracts for general stores, there was also an interesting passage. The Works Committee recommended the acceptance of tenders by an English firm for tubes and fittings. Bailie Kinloch Anderson, the Convener of the Committee, moved, against the finding of the Committee, that the contract be given to the Scotch firm who have had it for many years. He did so because the estimate was to be subject to test; and specimens of pipes which had been tested were produced at the meeting, showing that under the same test, the Scotch pipe, taken from stock, bent to right angles without fracture, whereas the English pipe, sent to be tested, had snapped right across before bending. The weights, it was also said, were all in favour of the Scotch pipe. Councillor Hunter, a metal merchant, supported the offer of the English firm. He said that no metal merchants kept Scotch-made tubes, &c.; and he expressed a desire to have a neutral test, which somewhat—and quite reasonably so—ruffled the temper of Bailie Kinloch Anderson, as it involved the insinuation that the test in the works had not been fairly carried out. Both the Engineers favoured the offer of the Scotch firm, on its merits and also on account of the fact that the fittings of the English tubes did not correspond with those they had already got from the Scotch firm. With such a weight of influence against Mr. Hunter, it was not surprising that he did not find a seconder; and the contract went to the Scotch firm—he alone protesting.

Among other matters before the Commissioners, were a letter of thanks from the Council of The Gas Institute, who expressed themselves as gratified with the proposals of the Commissioners for their entertainment in June; a protest by several members that the electric lighting interest in the City were rather over-writing the subject of the danger of explosions in electric light culverts from escapes of gas, and a disavowal of the responsibility of the Commissioners for any explosions which may occur; and also a proposal by the North British Railway Company for a re-arrangement of the terms upon which the Company provide hydraulic power in the Edinburgh works—the power required being now very much greater than it was when the agreement was entered into in 1883.

The Rothesay Police Commissioners met specially on Monday to consider the subject of the purchase of a new site for the Corporation gas-works. Provost Milloy called upon the opposition—the other side having been heard a fortnight previously. The opposition was not based on any consideration as to the desirability of procuring a site upon which extended works might be erected, but was the outcome of the natural timidity there is among municipal representatives in small towns with regard to the spending of public money. The price proposed for two acres of ground, with buildings upon it, was £2500; and the leader of the opposition calculated that, when they paid interest upon the sum and £4 a year feu duty, the annual charge upon the Commissioners would be at the rate of £40 per acre, which he considered would be too much. He could not see why, having expended so much upon the gas-works in recent years, they should require a new site. He thought that if they adopted the Burghs Gas Supply Act, there would be difficulties in regard to the compulsory repayment of capital, the loss of the gas profits to the burgh (with the consequent raising of the rates), the loss of the power to charge for breaking up the roads, and other matters, though each small in themselves, made, when taken together, a somewhat formidable mass of objection. The seconder of

the motion that they do not acquire Broadcroft Mills had made the discovery that the new site was wanted in order that they might erect a sulphate of ammonia plant, from which they expected to make an annual profit of £200; and, thinking that this was the only reason for the change of site, he argued that they should not incur such a large outlay for so small a return. Mr. J. Ballantyne, the Manager, when appealed to, gave a different aspect to the subject. From 1881 to 1887, he said, the increase in the output of gas was 9·66 per cent.; and since then, it had been 52·40 per cent. During the time he had been at Rothesay, the number of gas-fires in use had increased from 53 to 280 cookers and about 200 heaters. On the night of Dec. 31 last, there was an output of 168,000 cubic feet of gas; and their total capacity was 175,000 cubic feet per day. After discussion, it was resolved, by a majority of 8 to 5, to purchase the Broadcroft Mills at the price of £2500. The subject of the adoption of the Burghs Gas Supply Act was not taken up.

On Tuesday of this week, gas annuities amounting to £73 10s. payable by the Dundee Gas Commissioners, were exposed for sale by public auction, and were purchased on behalf of the Commissioners for £343 10s. per £10 annuity. When shares were last purchased (now more than a year ago), the rate was £335 per £10. As the amount of the annuities decreases, the rate for them is steadily rising, which makes the acquisition of them by the Corporation more difficult.

On Wednesday night, at a meeting of the Brechin Town Council, Provost Vallentine raised the subject of the Corporation acquiring the undertaking of the Brechin Gas Company. He was not in favour of a compulsory transfer, he said, but thought the present was a good time for negotiating a purchase. He regretted that they had not purchased 20 or 30 years ago, when they would possibly have got the works for less money; but he was of opinion that they might consider the matter. He did not go further than to intimate that he would probably make a motion on the subject at their next meeting.

Mr. A. Smith, Engineer and Manager of the Aberdeen Corporation Gas-Works, has completed the erection of the large new gasholder of nearly four million cubic feet capacity at Gallowhill, beside the town links. The holder is 210 feet in diameter; and has three lifts, each 40 feet in depth. There are 24 guide-standards, 122 feet in height; and these are connected by four rows of lattice girders, which are braced together by diagonal ties. The holder itself, with the framing and guides, is of Siemens-Martin mild steel. The history of the construction of the holder is somewhat unique. There was a good deal of distress in the city two winters ago; and in order to give employment to a number of men who were in enforced idleness at the time, Mr. Smith, having stated that a new gasholder would be required, was requested to proceed with the excavation and construction of the tank, with men working under his own supervision. He undertook the work; and, with his accustomed energy, he soon accomplished it without a hitch. The soil was sand, of a very compact nature; and I learn that this fortunate circumstance aided him immensely, in respect that, while the slopes of the tank were able to be kept much steeper than is usual in such excavations—thereby making the quantity of material excavated much less—there was the further advantage that the timbering required was exceedingly slight. On the completion of the tank, the construction of the holder was let to the Barrowfield Iron Company, of Glasgow, who, as they did in the case of the large gasholder at the Dawsholm works at Glasgow, sub-let the work of erecting the guide-standards to Sir William Arrol and Co. The work was to have been completed by July 1, but has been finished much within the time allowed. At present, the holder is being blown up; and I understand everything is found to be satisfactory. The total cost of the tank and holder will be about £35,000, which is at the rate of between £8 to £9 per 1000 cubic feet, and makes the holder the cheapest ever constructed in Scotland. A main has been already laid to connect the holder with the gas-works; so that, as soon as the painting of the shell is completed, it can be at once brought into use.

The Falkirk Gas Commissioners have closed contracts for coal and oil for the year from Whitsunday next. They have selected 7000 tons of coal from seven different firms; and they estimate that they will require 450 tons of oil. The contracts were somewhat hurriedly concluded, under the fear—which, so far, appears to me groundless—that the prices of both coal and oil would rise.

At a meeting of the Perth Gas Commissioners on Thursday night, a recommendation by the Works Committee to expend £100 in the purchase of gas cookers and heaters came up. In support of the recommendation, it was stated that last year the return on the money which the Commissioners had expended upon these articles was at the rate of 9½ per cent., and that a million and a half cubic feet of gas had been sold for them. A most unaccountable opposition to the recommendation was raised, some of the members thinking that it was imprudent to invest money in property which was being so rapidly improved that it would soon be no better than old iron. One of the opposition even went to the length of basing his objection to the recommendation on the ground that the increased output of gas required by these articles necessitated outlays upon the gas-works, to enable them to meet the demand, which created a burden upon poor people; and he thought they would be better to make less gas. I confess I cannot follow him in his strange doctrine; and I am glad to see that the Commissioners, by a majority of 17 to 5, adopted the recommendation of their Committee.

Sulphate of ammonia has fallen to £9 10s. per ton; but it is considered likely that the price will now harden a little.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 27.

Sulphate of Ammonia.—The decline in prices which throughout the month has been recorded has continued during the past week; so that, at the close, the value of good grey 24 per cent. cannot be put at over £9 10s. to £9 12s. 6d. per ton f.o.b. at the ports. The situation must be partly attributed to the action of speculators, who all along have been "bearing" the market, and who have been able to cover with a good margin of profit. The larger production, owing to the protracted and severe winter, and some falling off in export demands has no doubt favoured "bear" operators; but it must be admitted that makers themselves, in their anxiety to pick up such orders as have come on the market, have also contributed to the present acute depression. At the low level reached, however, there is more inquiry for autumn shipment, and disposition to buy ahead, if at something like the basis of present prices. But makers are not inclined to commit themselves so far forward, unless at such prices as buyers will not pay. It is felt that the position of sulphate can hardly be worse during the season of small production, and that any important demand from new sources which may be induced by present low prices may bring about a recovery in values. Nitrate of soda is quiet in all positions, and 8s. 3d. per cwt. is the nearest value of fine quality on spot.

LONDON, *April* 26.

Tar Products.—This market has been fairly steady during the week, with some considerable business being done. Large lines of pitch and carbolic acid have been booked for prompt, but more for forward, delivery. Creosote and common oils do not realize better prices, notwithstanding the large advances in common petroleum oils. There is a little more inquiry for benzol for the last half of the year; but sellers are indisposed to accept the present low prices so far forward. Anthracene is firmer; and it is said there is more business doing. The average prices obtaining during the week are: Tar, 18s. to 21s. Pitch, 33s. to 34s. Benzol, 90's and 50's, 1s. 0½d. Solvent naphtha, 1s. Toluol, 1s. 1½d. Crude, 30 per cent., naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, 1d.; salts, 20s. Cresylic acid white, 1s.; brown, 10d. Carbolic acid, 60's, 1s. 7d. Anthracene, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia, after a period of exceptional depression, to-day looks as if it might see better times; but whether this is only a temporary improvement remains to be seen. Quotations have ranged between £9 5s. and £9 10s. at the various ports, less 3½ per cent.; while gas liquor is priced at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no specially new feature to notice with regard to the gas coal trade, beyond what I have already referred to. Some confirmation of the excessively keen competition which is likely to be experienced, is to be found in the fact that one large company which was cut out in the competition last year in respect to one of the most important local contracts is said to be determined that this year they will, under any conditions, not be cut out again, but will secure at least some portion of this contract, of which previously they have invariably had a share. I have nothing to add as to prices; and as yet it is too early to give anything like really definite figures. With regard to the condition of the general trade, the position undergoes no very material change; the advancing season necessarily bringing about a steadily lessening demand for house-fire qualities, whilst the commoner descriptions of round coal remain in but very moderate request for iron making, steam, and general manufacturing purposes. The outlook in this direction may, however, if anything, be regarded as rather more hopeful, as the iron and other coal-using industries in the district are showing some sign of returning activity. The shipping trade remains excessively dull; and orders are only obtainable at exceedingly low figures, which some of the local colliery owners do not care to entertain. The restricted production of slack moves off moderately well; but there are some low offers even in this class of fuel. Pits for the most part are scarcely working more than about four days per week; but the quantity of stock going down is comparatively small. At the pit mouth, best Wigan Arley averages 10s. to 10s. 6d. per ton; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; common house coals, 7s. to 7s. 6d.; steam and forge coals, 6s. to 6s. 6d.; and engine fuel, from 3s. 6d. to 4s. for common, up to 4s. 6d. to 5s. for better qualities. Steam coal, delivered at the ports on the Mersey, is quoted at 7s. 6d. to 8s. per ton.

Northern Coal Trade.—There has been a better demand for coal the last few days; the shipments being fuller through the opening of more of the Baltic ports. Best Northumbrian steam coal is now more in request; and the price is firm at about 8s. 9d. per ton f.o.b. For small steam coals, there is also a good demand; and from 3s. 9d. to 4s. is the quotation. In manufacturing coals, there is rather a better inquiry, some of the factories having fuller work; but the price is unchanged. In regard to gas coals, lower prices are now generally quoted. About 6s. 6d. to 6s. 9d. per ton f.o.b. may be looked on as the general quotation for gas coals, though one or two collieries ask rather higher prices. Contracts continue to be made for small quantities of gas coals; but nothing further has been done, as far as is known, in regard to larger ones to replace those that will expire at the end of June. Those that are being settled seem to be at about the higher of the prices just named. In regard to the coke trade, there is now a fuller demand for export; but the price is generally still on the basis of 12s. 6d. to 13s. per ton f.o.b. Gas coke is unchanged in price; but the stocks seem to be lower this week. The question of the settlement of wages of the miners in Durham is not expected now for some days; but the meeting with the Umpire has been determined on, and it is probable that the decision will have to be given by him shortly. There is no doubt this will take the form of a reduction of wages to some extent.

Scotch Coal Trade.—The coal trade in Scotland remains in an unsatisfactory condition. Business is mostly of a hand-to-mouth character, with prices, if anything, tending to droop. As has been the case for several months, the greatest demand is for ell; the other varieties being, as last week, in only fair demand. Nuts and dross are going off pretty freely, at very low prices. The miners' delegates, while advising resistance to the proposed reduction of 6d. per day, have resolved to postpone till the middle of May coming to a decision whether the men should accept of the reduction. Meanwhile the reduction has come into force, and the men are working everywhere upon it. The prices quoted are: Main, 6s. per ton f.o.b. Glasgow; ell, 7s.; splint, 6s. 6d. to 6s. 9d.; steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 121,873 tons—a decrease on the quantity in the preceding week of 19,823 tons, and on the quantity in the corresponding week of last year of 41,339 tons. For the year to date, the total shipments have been 1,732,623 tons—a decrease upon the quantity in the same period of last year of 403,778 tons.

Tarapaca Water-Works Company.—The Directors of this Company report that the net profit for the year ending Dec. 31 last was £49,424. After paying the interim dividend, carrying £15,000 to the reserve fund, writing off £1500 for preliminary expenses, and paying a further dividend of 2½ per cent., there is a balance of £2924. Adding the amount brought forward—£20,755, less £16,685 written off—£4070, there is a net balance of £6994 to be carried forward. The Directors state that the works are in excellent condition, the supply of water continues good, and the prospects of the Company are satisfactory.

New Joint-Stock Companies.—The Aspatria Gaslight Company, Limited, has been registered with a capital of £2000, in £5 shares, for the incorporation as a limited company of an unlimited concern, originally incorporated on Jan. 6, 1860, with a capital of £1500 in £5 shares, and to carry on the business of supplying gas to the township of Aspatria, Brayton, Cumberland. The General Traction Company, Limited, with a capital of £50,000, in £5 shares, has been formed to adopt and carry into effect an agreement expressed to be made between the Electric and General Contract Corporation, Limited, of the one part and the Company of the other part, and to enter into or acquire and carry out contracts or concessions or other grants in any part of the world for constructing, purchasing, or working railways, tramways, telegraphs, telephones, electric and other lighting works, electric, hydraulic, or other works, and for the equipment of any such undertakings or works with electric or other plant, stock, or apparatus.

The Kingston Town Council and the Lambeth Water Company.—With reference to the claim which the Corporation of Kingston recently made in a letter to the Lambeth Water Company for expenses incurred in the distribution of water among householders during the frost, the Secretary (Mr. H. Wilkins) has written to the Town Clerk to the effect that he had been directed to repeat that the Company could not recognize the claim of the Corporation to repayment of expenses which were voluntarily incurred in delivering water. His Board, however, without prejudice to their legal rights, either on the present occasion or in similar circumstances at any future time, would be happy to contribute £168 towards the expenses, on the understanding that all claim to repayment as a matter of right was previously withdrawn. As regarded the suggested lowering of the mains, it was the intention of the Directors to relay at a greater depth—say, 3 feet—where circumstances permitted, all mains which had been frozen by the late frost, as opportunity offered.

Monte Video Water-Works Company, Limited.—The ordinary general meeting of this Company was held at Winchester House, on Monday, the 8th inst. Mr. F. S. Isaacs occupied the chair. The Directors' report, the principal figures in which were given in the JOURNAL last week (p. 765), was unanimously adopted. It was accompanied by a long printed statement as to the proposed new water supply for Monte Video, a concession for which is being applied for by a private Syndicate, on the basis of compulsory rating in their favour. The Directors pointed out that the effect of this would be to give the Syndicate a practical monopoly of the water supply of the city, and so to supersede and destroy the rights and interests of the Company; and the statement was intended to show that such a proposal could not be granted, having regard to the Company's rights under the original contract with the Government constituting the concession. After setting forth in detail the ways in which the scheme violates the Company's rights, the Directors, in conclusion, expressed the hope that the Government, when the whole of the facts and considerations were made known to them, would be induced to change their recent attitude towards the Company. Mr. J. Morris, in the course of a long speech, gave details as to the Company's position, and moved for the appointment of a Committee, representing the share and debenture holders, to act with the Directors in defence of the Company's property and rights. Mr. E. Woods seconded the motion; and it was carried unanimously. The retiring Directors and Auditors having been re-elected, the thanks of the meeting were accorded to the Secretary (Mr. J. Anderson), the staff, and the Chairman.

Mexbro' Water Question.—Local interest in the subject of the purchase of the Mexbro' Water Company's works by the District Council, at a cost of £10,000, has been revived by a report from Professor A. H. Green as to the prospect of obtaining an adequate yield of water for the town. He does not think it will be safe to reckon on obtaining from the present well an average supply of more than 70,000 or 80,000 gallons, which represents about 10 gallons per head per day. The existing source of supply will only meet the needs of the population for eight years; and Professor Green, therefore, recommends that a supplementary supply should be obtained. There are, he says, other sources in the neighbourhood from which water can be procured, of good quality and quite suitable for domestic uses. A largely-attended meeting of the ratepayers was held on Thursday last, in response to a memorial, to discuss the question of the proposed purchase. Mr. C. Scorah, J.P., Chairman of the District Council, presided. Mr. Lee, one of the Overseers, spoke at length in criticism of the undertaking, and concluded with a motion to the effect that the scheme be not entertained. He spoke of the heavy rates; and said the proposed purchase would cost £14,000, besides which, according to the expert who had been consulted, a supplemental supply would be needed in eight years, which would mean an expenditure of another £7000. The motion having been seconded, other speakers followed; the purport of their remarks being as to the likely burden to the ratepayers during the present depressed state of trade and high rates. Mr. Schofield, the Secretary of the Water Company, ridiculed some of the remarks, and was called to order. Mr. Tiptaft held that the scheme was not a rosy affair; but that could not be expected. He maintained that the policy of the Council in the matter was right. The Chairman spoke to like effect, and asked the meeting not to pass the resolution, seeing how far the matter had gone. They should be honourable with the Water Company, especially in view of the meeting of the ratepayers held in 1893, when the local authority were urged to obtain possession of the undertaking. Ultimately the resolution was lost by a large majority; the general feeling being that the ratepayers should put confidence in the members of the Council, who had had the matter under consideration for a long time.

Messrs. R. Dempster and Sons, Limited, have secured the contract for retort mountings for the Forfar Corporation Gas-Works.

Oriental Gas Company.—The Directors of this Company have resolved to pay an interim dividend on and after June 4 next, at the rate of 3½ per cent. (the same as last year), on account of the twelve months ending June 30, 1895.

The Mining Districts and Towns' Water Supply Syndicate, Limited, with a capital of £5000, has just been registered, with the object of establishing and carrying on the business of a water supply company in any part of the world.

Gas Affairs at Macclesfield.—The Gas Committee of the Macclesfield Corporation have decided to reduce the price of gas from 2s. 10d. to 2s. 8d. per 1000 cubic feet; to hand over £2000 to the reduction of the rates; and to add £700 to the reserve fund.

The Gas Supply of Hinckley, under the control of Mr. George Helps, experienced an exceedingly gratifying increase of nearly 25 per cent. during the last financial year, compared with the corresponding period of 1893-94—and this on large increases in previous years. The make in 1891 was 30,450,000 cubic feet; and last year 45,600,000 cubic feet—or an increase of just over 50 per cent. in five years.

Sales of Shares.—Messrs. Penney and Clark have recently sold at Southsea £50 "C" shares in the *Portsea Island Gas Company* at £124 to £128 each, and also shares in the *Portsmouth Water Company*, at the following prices: £10 shares (1857 issue), at £29 each; £5 shares (1861 and 1868 issue), at £14 10s.; £5 shares (1879 issue), at £10 and £10 5s.; and £5, £4 paid (1883 issue), at £8 10s. to £8 15s.——At a sale at Grantham yesterday week, seven old shares in the *Grantham Gas Company* realized £43 5s. each; and ten shares in the *Grantham Water Company* fetched £23 10s., and one £24 10s.——£10 shares in the *Aberdare Gas Company* have been sold by auction at £17 7s. 6d.——At a sale by auction at Torquay last Wednesday, upwards of 70 shares in the *Torquay Gas Company* were disposed of. For shares earning 10 per cent. dividend, £22 12s. 6d. and £22 15s. was paid; and for 7 per cent. shares, £16 to £16 10s. was realized. These are said to be the highest prices yet obtained.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 869.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	21—22	..	4 15 5
100,000	10	„	7½	Do. 7 p. c.	10	14—15	..	5 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
200,000	5	14 Nov.	6½	Bombay, Limited	5	6¾—7	..	4 12 10
40,000	5	„	6½	Do. New	4	4¾—5¼	..	4 19 2
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	243—248	..	4 12 8
180,000	„	„	8½	Do. New	100	195—200	..	4 5 0
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220—225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	120—123	+1	4 1 4
320,000	20	28 Mar.	11¼	British	20	50—51	..	4 8 2
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	„	8½	Do. 7 p. c.	10	16—17	..	5 0 0
328,750	10	14 Nov.	2	Buenos Ayres (New) Limited	10	6¼—6¾	..	2 19 3
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100—103	..	5 16 7
150,000	20	28 Feb.	8½	Cagliari, Limited	20	26¾—27¾	..	6 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	283—288	..	4 13 9
165,000	„	„	10½	Do. New do.	100	212-217	..	4 16 9
160,762	„	13 Dec.	4½	Do. 4½ p. c. Deb. do.	100	130—135	..	3 6 8
800,000	Stck.	13 Dec.	13	Continental Union, Limited.	100	247—252	..	5 3 2
200,000	„	„	10	Do. 7 p. c. Pref.	100	205—210	..	4 15 3
535,000	Stck.	28 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	100	120—125	+2	4 4 0
486,090	10	31 Jan.	11	European, Limited	10	24—25	..	4 8 0
354,060	10	„	11	Do. Partly paid	7½	17—18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	265—270	..	4 8 11
100,000	„	„	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	„	„	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	..	3 11 5
30,000	„	„	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	„	„	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	„	„	7	Do. H, 7 p. c. max.	100	185—190	+2	3 13 8
463,000	„	„	10	Do. J, 10 p. c. Prf.	100	275—280	..	3 11 5
476,000	„	„	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	„	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	129—132	..	3 0 7
294,850	„	„	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	„	„	6	Do. 6 p. c. do.	100	188—192	..	3 2 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	240—245	..	4 18 0
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met.of Melbourne, 5 p.c. Deb.	100	109—111	..	4 10 1
541,920	20	14 Nov.	5	Monte Video, Limited	20	15¾—16¾	..	6 1 2
150,000	5	29 Nov.	8	Oriental, Limited	5	7—7¼	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾—5¼	..	6 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1¾—2¼	..	8 0 0
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	105—109	..	5 10 1
500,000	100	1 Dec.	6	2nd Do.	100	102—107	..	5 12 1
150,000	10	26 Apl.	7	San Paulo, Limited	10	8¾—9¼*	..	7 7 4
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	350—360	..	4 6 1
1,350,000	„	„	12	Do. B do.	100	293—298	..	4 0 6
290,000	„	„	13	Do. C do.	100	305—310	..	4 3 10
775,000	„	16 Jan.	5	Do. 5 p. c. Deb. Stk.	100	167—172	..	2 18 2
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	28 Dec.	10½	Chelsea, Ordinary	100	278—283	..	3 11 6
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	213—218	−2	3 13 5
651,740	„	28 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	151—156	..	2 17 8
700,000	50	13 Dec.	8½	Grand Junction	50	109—113	..	3 15 3
708,000	Stck.	14 Feb.	12	Kent	100	303—308	..	3 17 11
1,043,800	100	28 Dec.	9½	Lambeth, 10 p. c. max.	100	245—250	..	3 16 0
406,200	100	„	7½	Do. 7½ p. c. max.	100	200—205	..	3 13 2
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	136—140	..	2 17 2
500,000	100	14 Feb.	12¾	New River, New Shares	100	370—380	..	3 7 0
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	140—143	..	2 15 11
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	147—152	−1	3 19 0
126,500	100	„	6	Do. D 7½ p.c. do.	100	140—145	..	4 2 9
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	268—273	..	3 13 3

*Ex div.

The Eccup Reservoir of the Leeds Corporation.—The Leeds Corporation Water Committee have decided to proceed as soon as possible with the construction of the third and remaining portion of the embankment at the Eccup reservoir. The work, which is not to cost more than £21,000, has been let to Mr. Gould, of Hunslet, who has had the previous contracts. This extra work will take about two years to complete.

Exhibitions of Gas Appliances.—Last Tuesday an exhibition of gas appliances was opened in the Corn Exchange, Coventry, and will be continued until Thursday next. Among the firms exhibiting were: The Incandescent Gas-Light Company, Messrs. T. Glover and Co., Messrs. Sawer and Purves, Messrs. G. Bray and Co., Messrs. Orme and Co., Messrs. Richmond and Co., Messrs. Best and Lloyd, and the Coventry Gas-Fittings Company. Lectures by Miss Amy Wilkinson are being delivered twice daily. Last Tuesday, a gas exhibition was opened at Portsmouth, with lectures by Mrs. Thwaites. The Davis Gas-Stove Company, Limited, held a very successful exhibition from Tuesday to Friday last week at Horley; Miss B. Cameron lecturing twice daily. Last Tuesday a gas and trades exhibition was opened in the Grand Skating Rink, Brighton, by the Mayor (Alderman Botting, J.P.). It was promoted by Messrs. Richmond and Co., Limited, who have an excellent display of their gas appliances. It will remain open till next Saturday; and Miss Owen is giving cookery lectures twice daily. An exhibition of Messrs. Fletcher, Russell, and Co.'s gas-stoves was held from Tuesday to Friday last week in St. Bartholomew's Parish Room, Montpelier; cookery lectures being given twice daily by Miss R. Brown.

Enfield Water Supply.—At the meeting of the Enfield Urban District Council on the 18th inst., the scheme for an improved water supply prepared by their Consulting Engineers, Messrs. Taylor and Crimp, was adopted; and it was resolved to apply to the Local Government Board for sanction to borrow £11,000 for the execution of the work. The works comprise the sinking of a new well through the tertiary formation; the driving of 300 feet of headings in the chalk; and the provision of a new pumping-station, with engines in duplicate, of 120-horse power.

Stafford Corporation Gas Department.—At the monthly meeting of the Stafford Town Council last Tuesday, the Gas Committee recommended that the sum of £500 be transferred from the profits of the undertaking towards the rates of the town. Alderman W. H. Peach, in moving the recommendation, said that the increase in the consumption of gas was about 12½ per cent. This was the largest advance the Committee had ever reported since the works were taken over. The exhibition in October no doubt aided this, as afterwards the number of gas fires and stoves sent out on hire was nearly doubled. As to the future, he thought that with the "boom" in the petroleum world the consumers would, if they were wise, resort to gas. They had now something like 800 consumers and cottages on the penny-in-the-slot system, which was a great benefit. The Committee recommended that this year the £500 be paid to the borough fund instead of the district fund, as there had been a considerable expenditure on the baths, and the borough rate was the one paid by the poorer inhabitants. The recommendation was adopted.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

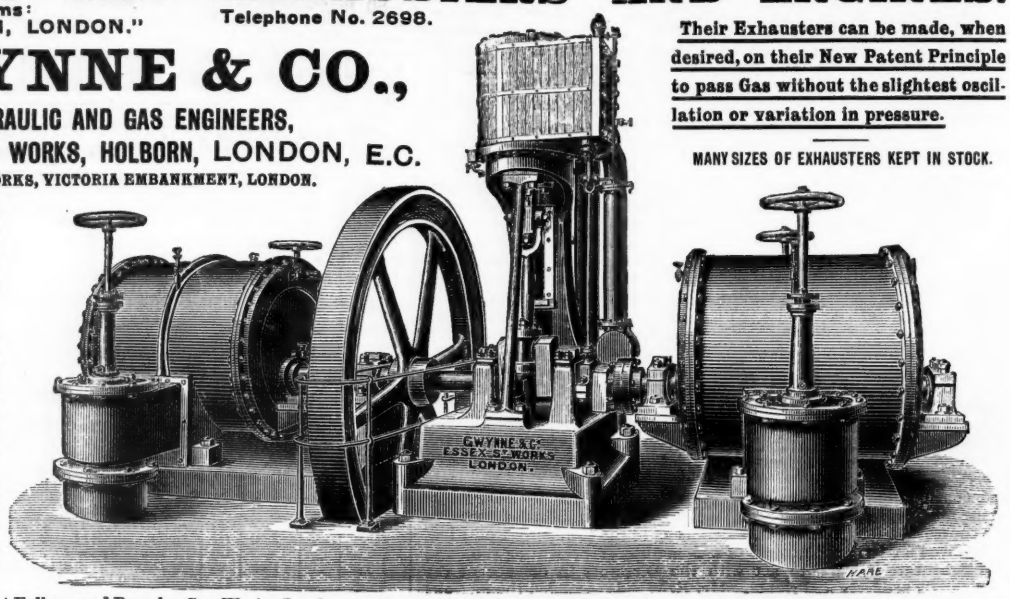
GWYNNE & CO.,
HYDRAULIC AND GAS ENGINEERS,
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director,
Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works.

ANDREW STEPHENSON,
182, GRESHAM HOUSE,
OLD BROAD STREET,
LONDON, E.C.

Telegrams: "Volcanism, London."

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

W. C. HOLMES & CO., Huddersfield;
AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also Improved Patent Rotary Scrubber-Washers.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited,
Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
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For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality.
Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

AMMONIA SATURATORS.

WALTER THOMASON and SONS,
Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

PORTER & CO., Gowts Bridge Works,
LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

WANTED, a Situation. Twelve years' experience. Recently Working Manager; 2½ millions make. Good testimonials.
Apply, by letter, to No. 2520, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RETORT Setter requires permanency (Foreign preferred). Competent to prepare Plans on all known Principles, or to erect on Engineer's own Plans.
Address No. 2516, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PARTNERSHIP.

A GENTLEMAN, with Established and Profitable Business, would JOIN OR AMALGAMATE WITH ANOTHER FIRM having a profitable Business.
Address No. 2514, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A YOUNG Married Man requires a Situation in Gas-Works as HANDY MAN. Thoroughly understands Main and Service Laying and Fixing Meters, or able to take charge of a Small Works. Good references.
Address ROBERT HOCKLEY, care of Mr. Banham, Gas-Works, Wymondham, NORFOLK.

WANTED, a Rivetter for about three weeks.
Apply to ALFRED FOREMAN, Gas Offices, HALESWORTH.

WANTED, for a small Gas-Works, a good STOKER, used to Shovel work, and to make himself generally useful.
Apply to the SECRETARY, Gas Company, Knighton, RADNORSHIRE.

WANTED, a Retort-House Stoker. One accustomed to Engine and Exhauster. Must be young, tall, and active. Permanent employment to a suitable man.
Apply, by letter, to W. D. CHILD, Manager, Gas-Works, ROMFORD.

G. J. EVESON wants a Representative, for Export and Inland Trade, who can sell Coal, Cannel, and Tubes anywhere in the United Kingdom or abroad where representative is not already appointed, either on Commission or Salary, or both, with adequate allowance for expenses.
Apply, by letter, to G. J. EVESON, Corporation Street, BIRMINGHAM.

WANTED, immediately, a Young Man, competent to inspect and fix Meters, lay Mains and Services, fix Gas Stoves and Fittings, and make himself useful as GENERAL FOREMAN of indoor and outdoor work. Wages, 28s. per week.
Applications, stating Age and Experience, with Reference as to character and last employment, to be addressed to

B. A. LEWIS,
Secretary and Manager.
Gas-Works, Carmarthen.

THE LLANDUDNO URBAN DISTRICT COUNCIL GAS-WORKS.

THE Council invite Application for the Appointment of a WORKING MANAGER, who must be prepared to devote the whole of his time to the service of the Council. His Salary will be £2 per week, with House, Rent, and Rates free, and with Coal and Gas. His duties will be to have the entire management of the Gas-Works, to keep the men's time, to keep account of all materials brought in and out of the said Gas-Works, and to report upon the whole from time to time and upon all materials, as called upon by the Council, or as directed by their Engineer. One month's notice on either side to terminate the engagement.
Each applicant must state his age and previous experience, and the earliest date on which he could enter on his duties.
Applications, accompanied by three recent Testimonials, to be forwarded, in an envelope endorsed "Working Manager," to the undersigned not later than Monday, May 6 next.
Canvassing will disqualify.

A. CONOLLY,
Clerk to the Council.
Council Office, Llandudno,
April 26, 1895.

OAKHAM GAS COMPANY, LIMITED.

OWING to Alterations, the above Company have FOR SALE Ten 17 in. by 13 in. ⊂-shaped MOUTHPIECES, with Duplicate Lids and Cross-Bars, and length of HYDRAULIC MAIN for two Beds of Five Retorts, each with Ascension, Bridge, and Dip Pipes (4-inch), with Ash-Pans, Furnace Doors, Buckstays, &c. The above can be seen at work.
All Particulars and Offers to

JAS. MASON,
Manager.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
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SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

TO BE SOLD, at once—A small Gas-HOLDER, 75 feet diameter.
Further Particulars on application to BENJAMIN HAYNES, Gas-Works, Stretford, near Manchester.

PURIFIERS.

FOR SALE—Four 8 feet square Purifiers, with Sieves, Bearing-Bars, and Covers. Being removed to make room for larger ones.
Apply to the MANAGER, Gas-Works, Banbury, OXON.

GASHOLDER, 80 feet diameter by 24 feet deep, in good condition, FOR SALE; being replaced by larger one.
Full Particulars on application to No. 2519, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A 4000 per Hour Cylindrical STATION METER (Cowan), 6-inch Connections, Bye-Pass, and Slide-Valves, complete. Also two 8-inch STATION GOVERNORS (Peebles), with the necessary Slide-Valves. All in perfect working condition; being replaced by larger sizes.
For further Particulars, apply to

FRANK C. TAYLOR,
Secretary and Manager.
Gas-Works, Shanklin, I.W.

MARKET HARBOROUGH GASLIGHT AND COKE COMPANY.

FOR SALE.

OWING to Alterations, the above Company have the following FOR SALE, in good condition:—
Twelve 15-inch ROUND MOUTHPIECES.
Eight 14 in. by 14 in. ⊂-shaped MOUTHPIECES, with duplicate Lids and Cross Bars.
Length of HYDRAULIC MAIN for four Beds of five Retorts, with ASCENSION, BRIDGE, and DIP PIPES.
ASH-PANS, FURNACE DOORS, &c.
Further Particulars from, and offers to,

J. FRYER,
Manager.
April 20, 1895.

THE URBAN DISTRICT COUNCIL OF ABERTILLERY.

FOR SALE.

THE above Council have for Sale at their Gas-Works—
(1) A GASHOLDER, 30 ft. by 10 ft.
(2) A SCRUBBER, 10 ft. by 3 ft.
(3) A STATION METER, 1200 cubic feet per hour capacity.
(4) A number of 6-inch VALVES and SPECIAL PIPES.
The above can be inspected on application to the Manager at the Gas-Works, Abertillery.
Tenders for same, endorsed "Tender for Gas Plant," should be sent to the undersigned on or before the 4th day of May next.
The Council does not bind itself to accept the highest or any tender.
Dated this 1st day of April, 1895,

By order,
JNO. ALEX. SHEPARD,
Clerk to the Council.
Town Hall, Tredegar, Mon.

MANCHESTER CORPORATION GAS-WORKS.

AMMONIACAL LIQUOR.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the purchase and removal of the AMMONIACAL LIQUOR to be produced at the Gaythorn, Rochdale Road, and Bradford Road Gas-Works during a period of One or more Years, commencing at Noon on the 30th day of June, 1895.
The Committee do not bind themselves to accept the lowest or any tender.
Sealed tenders, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Ammoniacal Liquor," must be delivered at the Offices of the Gas Department, Town Hall, on or before Friday, the 24th of May, 1895.
Forms of Tender and further Particulars may be obtained on application, in writing only, to Mr. Charles Nickson, Superintendent of the Department.
A Deposit of One Guinea (which will be returned on receipt of the tender) must accompany each application for a tender form.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.
Town Hall, Manchester,
April 19, 1895.

COUNTY BOROUGH OF OLDHAM.

THE Gas-Works Committee are prepared to receive TENDERS for the supply of about 100,000 Tons of CANNEL and COAL required by them during the Year ending the 30th of June, 1896.
Specifications and Forms of Tender can be obtained on application to Mr. Arthur Andrew, Gas and Water Offices, Oldham, to whom tenders are to be sent on or before Tuesday, the 14th of May, 1895.

A. NICHOLSON,
Town Clerk.
April 23, 1895.

DENTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

COAL AND CANNEL.

THE Gas Committee invite Tenders for COAL and CANNEL; the same to be sent in on or before the 10th of May.
Specification and Form of Tender may be obtained from the Manager (Mr. J. Chadwick Smith), Gas-Works, Denton, near Manchester.
The Committee do not bind themselves to accept the lowest or any tender.

By order,
JOHN RICHARDS,
Clerk to the Council.
April 27, 1895.

DENTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TAR.

THE Gas Committee invite Tenders for TAR; the same to be sent in on or before the 10th of May.
Particulars may be obtained from the Manager (Mr. J. Chadwick Smith), Gas-Works, Denton, near Manchester.
The Committee do not bind themselves to accept the highest or any tender.

By order,
JOHN RICHARDS,
Clerk to the Council.
April 27, 1895.

BOROUGH OF BRIDGNORTH.

THE Gas Committee hereby invite TENDERS for the TAKING OUT of an old GASHOLDER, the LINING and DEEPENING of the TANK, and the erection of a NEW TWO-LIFT GASHOLDER on the Gadd and Mason Spiral-Guided System.
The Drawings and Specification can be seen at my Office, on application, *before* Saturday, the 4th of May.
Sealed and marked tenders must be sent to the undersigned not later than Saturday, the 11th of May.
Neither the lowest nor any tender will necessarily be accepted.

J. H. COOKSEY,
Town Clerk,
Secretary.
Bridgnorth, April 26, 1895.

BOROUGH OF BARROW-IN-FURNESS.

TO GASHOLDER MAKERS.

THE Corporation invite Tenders for the supply and erection of an INNER LIFT to a SINGLE-LIFT GASHOLDER, at their Gas-Works at Barrow-in-Furness.
It is desired that the additional Lift may be of the Columnless Type; and tenders should be accompanied by Drawings and Specifications, giving full Particulars of the manner in which it is proposed to carry out the work.
Further Particulars and Conditions may be obtained on application to the Gas-Works Manager.
Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Gasholder," to be delivered at the Town Clerk's Office not later than Twelve o'clock Noon, on Wednesday, the 15th day of May, 1895.
The lowest or any tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.
Town Hall, Barrow-in-Furness,
April 25, 1895.

LIVERPOOL UNITED GASLIGHT COMPANY.

THE Directors of the Liverpool United Gaslight Company are prepared to receive TENDERS for the supply of 80,000 Tons of CANNEL and 170,000 Tons of COAL, to be delivered at the various Works of the Company, during the period of Twelve Months between the 1st of July, 1895, and the 30th of June, 1896.
Tenders will be received for the whole or any portion of the above quantity.
The Directors reserve the right to accept tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.
Full Particulars and printed Forms of Tender can be obtained on application to the undersigned, at the Gas Office, Duke Street, Liverpool, to whom tenders, on the printed form, must be delivered, on or before Saturday, the 11th of May, endorsed "Tender for Cannel and Coal."

By order,
WILLIAM KING,
Engineer.
Gas Office, Duke Street,
Liverpool, April 23, 1895.

SCARBOROUGH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the Scarborough Gas Company are prepared to receive, on or before Noon on Saturday, the 11th day of May next, OFFERS for about 22,000 Tons of high-class COAL, suitable for Gas Making, for delivery in N.E. Railway Company's Waggons, at the Gas-Works Siding, Scarborough, in such monthly quantities as may be required for a period of One, Two, or Three Years, commencing the 1st of July next.

Particulars and printed Forms of Tender may be obtained on application (in writing only) from the undersigned, to whom tenders, duly endorsed "Tender for Coal," must also be addressed.

By order of the Board,
J. HOLLIDAY,
Engineer and Secretary.

Gas Offices: 32, Westborough, Scarborough,
April 19, 1895.

TUNBRIDGE WELLS GAS COMPANY.

TO COAL FACTORS AND OTHERS.

THE Directors of the Tunbridge Wells Gas Company will be prepared on Tuesday, the 7th of May next, to receive TENDERS for the supply of 17,000 Tons of either NEW PELTON, NEW TANFIELD, PELAW MAIN, EAST PONTOP, SOUTH HETTON, LONDONDERRY, or other approved GAS COALS, at the option of the Directors, to be delivered free into the Gas Company's Siding, on the South-Eastern Railway at Tunbridge Wells, in accordance with Terms and Conditions, which may be obtained on application.

The tenders are to be sent to me by not later than Six o'clock p.m., on Tuesday, the 7th of May, marked "Tender for Coals."

The lowest or any tender will not necessarily be accepted.

By order,
JOHN READ,
Secretary.

Gas Company's Office,
Tunbridge Wells, April 19, 1895.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 60,000 Tons of best well-screened large GAS COAL, to be delivered between July, 1895, and the 30th of June, 1896, in monthly quantities, in accordance with the Specification.

Parties tendering may do so for the whole quantity or for quantities from 5000 tons upwards.

Forms of Tender and Specification of monthly deliveries may be obtained on application to Mr. H. Morley, the Company's Engineer.

Sealed tenders to be sent to the undersigned not later than Twelve noon on Friday, the 10th day of May next, addressed to the Chairman of the Company, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order,
GEORGE CLARRY,
Secretary.

Gas Offices, Cardiff,
April 27, 1895.

LURGAN GAS, LIGHT, AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 2750 tons of best screened GAS COAL, delivered into Lighters *ex*-ship at Belfast, free of all Charges.

Delivery of 2000 tons will be taken before the 1st of November next; the remainder to be delivered at such times before the 1st of April, 1896, as may be required.

Vessels carrying from 200 to 300 tons can at once deliver into Lighters, and these Lighters be back for a further cargo within a period to be arranged and agreed upon by the Gas Company.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Ten o'clock in the forenoon of Monday, the 6th of May next.

The Directors do not bind themselves to accept the lowest or any tender.

FRED. W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
April 10, 1895.

WALLASEY GAS AND WATER WORKS.

TO COAL MERCHANTS AND OTHERS.

THE Wallasey Urban District Council are prepared to receive TENDERS for the supply of about 18,000 Tons of CANNEL and GAS COAL for their Gas-Works, delivered in Waggons at Duke Street, Birkenhead, separately, for One, Two, or Three Years, from the 30th of June next.

Specifications and any further Information may be obtained on application to the Engineer at the said Works.

Sealed tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal," to be left at my Office, as below, not later than Four o'clock in the Afternoon of Thursday, the 16th day of May, 1895.

The Contractor will be required to enter into a bond, with approved sureties, for the due performance of the contract.

The Council do not bind themselves to accept the lowest or any tender.

By order,
W. DANGER,
Clerk to the Council.

Public Office, Egremont,
Cheshire, April 25, 1895.

QUAKER'S YARD GAS AND WATER COMPANY, LIMITED, TREHARRIS.

THE Manager invites Tenders, together with Drawing and Specifications, for Two PURIFIER COVERS, 6 ft. 7 in. square, by 14½ in. deep, fitted complete with Air-Plugs, Test-Taps, and Lifting Eyes. Also two 6-inch DISTRICT GOVERNORS and CONNECTIONS for fixing same.

To be delivered free at Treharris Siding, G.W.R.

Tenders to be sent in, addressed to the Manager, on or before the 9th of May, 1895.

BOROUGH OF BRIGHOUSE.

TENDERS FOR COAL AND LIME.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of GAS COAL and BUXTON LIME required at the Brighouse Gas-Works during the Year ending June 30, 1896.

Specification and Form of Tender can be obtained on application at the Gas Engineer's Office, Public Offices, Brighouse.

Sealed tenders, stating price per ton delivered at the Gas-Works, or alongside the Gas-Works by the Calder and Hebble Canal, or at the Brighouse Railway Station, must be sent in on or before Saturday, the 4th day of May, 1895, addressed to the Town Clerk, Public Offices, Brighouse, endorsed on the outside "Tender for Coal" or "Lime," as the case may be.

The lowest or any tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Public Offices, Brighouse,
April 17, 1895.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TO COLLIERY OWNERS AND OTHERS.

THE Gas Committee are prepared to receive TENDERS for the supply of CANNEL and COAL for a period of One, Two, or Three Years, commencing upon the 1st of July next.

Forms of Tender and Specification, together with any further Information, may be obtained from the Engineer, Mr. S. Meunier, Stockport. No form of tender other than that issued by the Committee will be entertained.

Tenders, stating price per ton delivered at the Railway Stations, Stockport, endorsed "Tender for Cannel or Coal," and addressed to the Chairman of the Gas Committee, must be sent in on or before the 8th of May, 1895.

No tender will be accepted without satisfactory proof that the firm tendering pays the standard rate of wages, and observes the standard number of hours.

The Committee reserve the right to accept tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
WALTER HYDE,
Town Clerk.

April 26, 1895.

TO MANUFACTURING CHEMISTS.

TAR AND AMMONIA WATER.

THE Directors of the Loughborough Gas Company are prepared to receive TENDERS for the surplus TAR and AMMONIA WATER, to be produced at their Works for One Year, from the 30th day of June.

The estimated quantities will be about 350 Tons of Tar, and 900 Tons of Ammonia Water. The Tar and Liquor to be delivered into the Contractor's Boats at the Wharf, on the Derby Road, Loughborough.

The Strength of the Liquor to be tested by Twaddel's Hydrometer (temperature 60°); and the tender to state the price per ton of 4 degrees, rising ½ degree up to 8 degrees.

The Boats for the removal of the Tar and Liquor to be sent at such times as may be required.

Payments, 10th of following month.

Further Information may be obtained on application to the undersigned, to whom Tenders, in accordance with this advertisement, must be sent not later than the 10th day of May.

The Directors do not bind themselves to accept the highest or any tender,

J. B. BALL, C.E.,
Manager.

Loughborough, April 26, 1895.

MERTHYR TYDFIL GAS COMPANY.

TENDERS FOR COAL.
TO COLLIERY PROPRIETORS.

THE Directors of the Merthyr Tydfil Gas Company require TENDERS for the supply, for Three or Five Years, at the option of the Seller, of about 6000 Tons per Annum (or such other quantity as may be agreed upon) of the BEST QUALITY LARGE SCREENED GAS COAL, to be delivered on their Railway Siding (Taff Vale Railway), Gas-Works, Picton Street, Merthyr Tydfil, in such quantities as the Manager may from time to time require during a period commencing on the 1st of July next.

Payments will be made by net cash monthly for previous month's deliveries.

Further Particulars, with Specification and Form of Tender, may be obtained on application to the undersigned.

Tenders must be on the Company's printed form, otherwise they will not be considered; and the tender, sealed and endorsed "Coal," specifying the description of Coal, and the Pit at which it is to be raised, must be addressed to E. B. Evans, Esq., J.P., the Chairman of the Directors, and left at the Gas Offices, Merthyr Tydfil, not later than Ten o'clock a.m., on Monday, the 6th of May prox.

The Directors do not bind themselves to accept the lowest or any tender.

By order of the Board of Directors,
JOHN L. COCKER,
Manager and Secretary.

Gas Offices, Gas-Works,
Merthyr Tydfil, Glamorganshire,
April 15, 1895.

WYE GAS COMPANY, KENT.

TENDERS and Specifications are invited for the erection of a new GASHOLDER and TANK complete of 15,000 cubic feet capacity. Also SCRUBBER and CONDENSERS, suitable for a make of 2½ millions.

Tenders to be sent in on or before Saturday, the 11th of May to the Secretary.

The Directors do not bind themselves to accept the lowest or any tender.

W. LEWIN,
Secretary.

LANCASTER CORPORATION GAS DEPARTMENT.

THE Lancaster Corporation Gas Committee invite TENDERS, accompanied by Analyses, for the supply of 100 tons of PURIFYING MATERIAL (Hydrated Oxide of Iron), delivered in the Gas-Works Siding, Lancaster. Also for the purchase of about 200 tons of SPENT PURIFYING MATERIAL.

Samples of the Material offered may be sent, and Samples of the Spent may be obtained on application, to the undersigned, from whom any further Information may be obtained.

Sealed tenders, endorsed "Tender for Spent or New Purifying Material," to be delivered to W. O. Roper, Esq., Town Clerk, Lancaster, on or before Monday, May 20.

C. ARMITAGE,
Manager.

Gas-Works, Lancaster,
April 25, 1895.

By order of the Executors of the late Mr. George Garnett,

GAS AND WATER AND OTHER STOCKS AND SHARES.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, May 7, 1895, at One for Two o'clock precisely, in lots—

BARNET DISTRICT GAS AND WATER COMPANY—£40 "A" STOCK, £460 "C" STOCK, £90 "D" WATER STOCK, and three 4 per cent. MORTGAGE BONDS of £800, £200, and £200 each.

EDWARD COCKEY AND SONS, LIMITED.—Ten £10 fully-paid SHARES, and four 5 per cent. DEBENTURE BONDS of £25 each.

THE GAS-METER COMPANY, LIMITED.—Twenty £10 fully-paid SHARES.

Particulars of J. W. FARDELL, Esq., Solicitor, RYDE; of Messrs. FARDELL AND CANNING, Solicitors, Mitre Chambers, TEMPLE; of Messrs. ALFRED LASS, WOOD, AND CO., Accountants, 30, GRACECHURCH STREET, E.C.; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.

The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.

These Appliances can now be obtained solely of the undersigned.

Winchester House, London, E.C. J. A. KELMAN.

Fcap. 4to, Cloth, price 7s. 6d., post free.

Practical Photometry.

By William Joseph Dibdin, F.I.C., F.C.S.

LONDON: WALTER KING, 11, Bolt Court, FLEET STREET.

HARCOURT'S COLOUR TEST.

For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from

Mr. S. E. MILLER, 115, Cowley Road, Oxford.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
8 Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.

The LAW GUARANTEE & TRUST SOCIETY, LIMITED,

GUARANTEES FIDELITY.

Send for complete Prospectus, containing Balance-Sheet, Copy of Policy, &c., &c.

HEAD OFFICE:
49, CHANCERY LANE, LONDON, W.C.

LOW MOOR BLACK BED
GAS COAL.

YIELD OF GAS PER TON . 10,375 CUBIC FEET.
ILLUMINATING POWER . 17·50 SPERM CANDLES.
COKE . . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to
GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

SULPHATE OF AMMONIA
SATURATORS.

JOSEPH TAYLOR & CO.,
Central Plumbing Works, Town Hall Square,
BOLTON.

Practical Makers of all kinds of Saturators, and Specialists in every description of Lead Work required in connection with Sulphate Plants.
Special attention to Repairs.
Improved Lead-Burning Machines, Sulphate Bagging Machines, Copper Scoops, &c.

HIGHEST REFERENCES ON APPLICATION.

HOLMSIDE GAS COALS.
PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS
PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13¼ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

ALFRED WILLIAMS & Co.
(MATTHEW MILDRED)
71, 72 & 73, BANKSIDE,
SOUTHWARK, S.E.
UNIVERSAL PROVIDERS
FOR
GAS, WATER, & SEWAGE WORKS.
ENGINEERS & CONTRACTORS
FOR THE ERECTION OF COMPLETE GAS AND WATER WORKS, AND FOR RENEWALS AND EXTENSIONS OF EVERY DESCRIPTION.
PLANS & ESTIMATES ON APPLICATION.
MAIN LAYING AND RETORT SETTING.

THE DRUM
FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.
See Advertisement in last and next issue.

T. B. KITTEL, SHEFFIELD.
CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL
ENGLISH & SCOTCH CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON APPLICATION.
T. B. KITTEL, SHEFFIELD.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . . 10,500 Cubic Feet.
Illuminating Power . . 16·9 Candles.
Coke . . . . . 66·7 Coke.
Sulphur . . . . . 0·86 Sulphur.
Ash . . . . . 2·04 Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the
HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

PIPES, 2-in. to 8-in. PIPES, 2-in. to 8-in. PIPES.

MONIER-WILLIAMS & Co.

IRONFOUNDERS,

MIDDLESBROUGH.

KENT'S THICK GAS COAL

RAISED AT

The Wharncliffe Woodmoor Colliery,

BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham :—

Specific Gravity (Water 1).	1·276
Weight of One Cubic Foot.	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter.	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash.	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham, 8th August, 1894.

For Price, &c., apply to the

Wharncliffe Woodmoor Colliery Co LIMITED,

BARNSLEY;

Or to **Mr. W. H. HARVEY,**

17, Old Queen Street, Westminster, S.W.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,

for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

Telegrams, "INCLINED, LONDON."
Gilbert Little & Graham Ltd.
THE INCLINED RETORT SPECIALISTS.
GILBERT LITTLE
COMPLETE RETORT PLANTS ERECTED, STARTED, AND GUARANTEED.
MAURICE GRAHAM, A.M.I.C.E.
ENGINEERS CONTRACTORS AND Carbonizing Specialists.
3 & 4, LIME STREET SQ.
LONDON, E.C.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works, Spennymoor, 8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,

Yours truly,

A. B. COWAN,

Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

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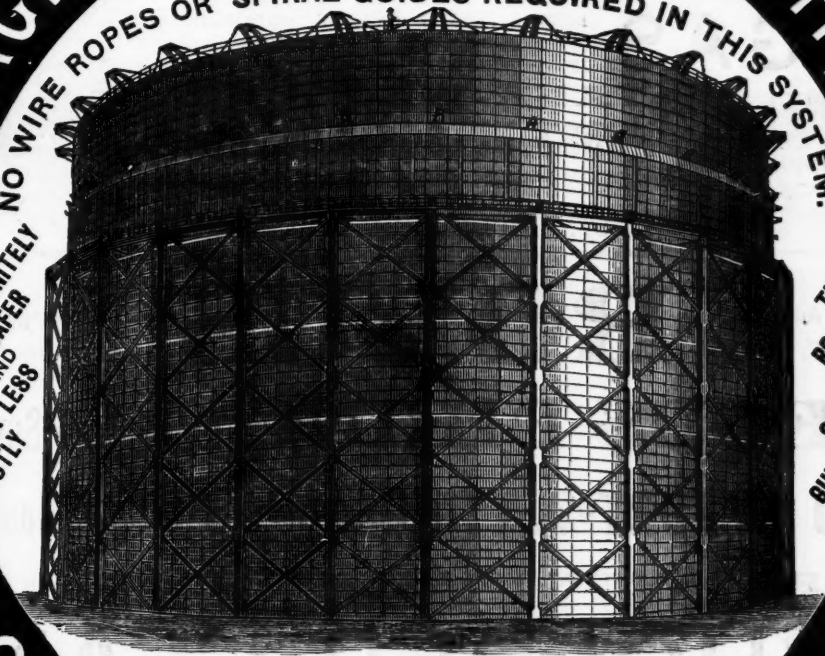

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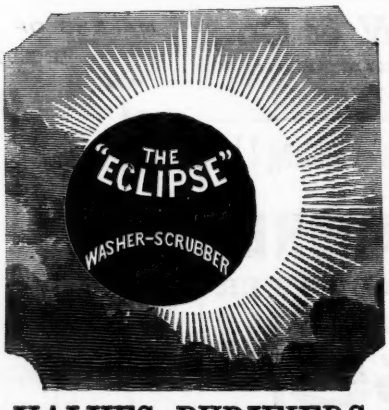

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